THE

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COAL-CUTTING MACHINERY AND ELECTRICAL ACCIDENTS IN MINES.

IN another part of our issue this week will be found the conclusion of a brief review on "Coal-Cutting Machinery and Electrical Accidents in Mines," based upon the annual Reports of H.M. Inspectors of Mines for the year 1909.

As regards coal-cutting machinery, it is a little disappointing—perhaps very much so to the Committee responsible for the Eight Hours Act, which depended so much upon the extended use of coal-cutters as the panacea for the hardships inflicted upon a patient and enduring public in the shape of enhanced prices due to reduction of output and other evils—to find that there has actually been a decrease in some districts, notably East and West Scotland, Durham and Yorkshire, though in others there has been a slight increase. It is, however, satisfactory to note that the electrically-driven machines still lead in the production of coal, 777 electrical machines producing 7,457,741 tons, against 6,260,161 tons produced by 914 compressed-air machines. Nearly one-half of the latter, however, are percussive machines, which are not adaptable for electric driving, whereas in the long-wall type machines electricity is particularly suitable, as is evidenced by the fact that out of a total of 1,223 machines, 767, or nearly two-thirds, are driven by electricity.

No doubt the introduction of the Eight Hours Act has had an adverse effect upon machine mining to some extent, but we cannot help being of the opinion that only time is required for this to automatically adjust itself, and machine mining is bound to extend as the owners and workmen become better acquainted with the advantages to be obtained by its adoption. The former would reap more profit from an increased production at lessened cost, while the latter would earn better wages with a less expenditure of physical labour, and the general public would also benefit in some way or other.

With regard to accidents, the dominant note throughout the reports is one of negligence—we do not say wilful negligence, but rather that based on carelessness and ignorance. With the exception of one or two, which were pure accidents, and which no amount of supervision would have warded off, the majority could have been prevented had only a certain amount of electrical engineering skill and a great deal of ordinary common-sense been employed in designing and supervising the working of the installation. In many cases the special Rules have been wilfully ignored, the managers making the excuse that, as the plant was installed before the Rules came into force, they did not apply to it. The truth is rather that they *did not want* them to apply; and it becomes an important question as to how many such installations remain which are in all probability merely death traps to unsuspecting workmen, and which may not be found out until an accident occurs. We

have no wish unduly to harass the colliery manager; he has quite enough, what with pleasing his employers, handling refractory men and boys, and being responsible to the law for the proper installation of all machinery and working of the mine, to keep him awake both day and night if he attempts to fulfil his duties conscientiously; but surely if he accepts the responsibility he ought to do his utmost to see that the Rules are properly carried out, or take the consequences of his remissness.

In the August number of *Cassier's Magazine*, Mr. T. Good directs attention to the fact that mining accidents are on the increase, and raises the question whether the introduction of electricity has not been the cause of recent explosions and fires. It will be remembered that the cause of the West Stanley Pit disaster, in the opinion of very many people, was attributed to electricity, but no evidence was brought forward that conclusively proved that this was so; and beyond this very doubtful instance there is no suggestion on record that electricity has been the cause of any very serious accident. There are cases on record where electricity has caused an explosion of fire-damp, two being given in the above-mentioned review—but no one would dare to say that this is a reason why electricity ought not to be allowed in a mine. In nearly every case it has been conclusively proved that it was not the fault of this very useful and most economical mode of transmission of power, but the foolish, and almost criminal, way in which it was installed and used. It is just as reasonable to say, because an accident has happened through a man tampering with or breaking a safety lamp, that safety lamps ought not to be allowed, and that miners working in gassy mines must return to the old flint mill for illumination.

Mr. Good, however, points out that during the years 1903 to 1909 only 51 deaths were recorded as due to electricity, which, considering all things, cannot be said to be a great number; but it is too many, and, if reasonable precautions were taken, we are convinced that fatal accidents would be few and far between. The same writer touches the real reason for the present state of affairs with regard to electricity in mining, when he says :—"What leading colliery electricians do emphatically insist upon—and this is the point of real importance — is that a number of mine owners refuse to employ either efficient or sufficient staffs to maintain their electrical installations at a reasonable pitch of safety." This is quite true, and until this is remedied there can be no hope of any material improvement. The astonishing thing about it is that the mine-owners themselves either cannot, or will not, see that it is to their advantage—to say nothing of preventing loss of life—to see that the installation is kept in thorough working order by a man who knows his business.

It is our opinion—which we have reiterated over and over again—that the only solution of this question is the granting of a certificate to the engineer, who must be thoroughly acquainted with both the mechanical and electrical engineering of collieries and trained to the work in the same way as the certificated colliery manager is now trained, and who will have absolute control and responsibility. At present there would be difficulty in finding such men, but as their status and consequently their pay would be raised, there would soon be a class of men available and ready to present themselves for examination. We had most earnestly hoped that this would be the aim of the Institution of Mining Electrical Engineers, but unfortunately this is too hopelessly in the hands of the colliery managers to be expected to do anything to advance this very desirable change in the management of our collieries, and the consequent reduction of accidents.

Supply Authorities and Manufacturers.

The importance of some degree of co-operation between supply authorities and manufacturers is becoming increasingly recognised. The necessity for harmonious feeling between central-station engineers and contractors has long been admitted, and in the majority of towns both are working together with the common aims of popularising the use of electricity, and occasionally making a profit, though there are just now several towns where their relations are anything but harmonious. Whilst it is important that there should be agreement between those engaged in installing light and power and the suppliers of energy, it is no less vital to the well-being of the industry that it should be recognised that the interests of the central station and those of the manufacturer are identical. The manufacturer on his part is improving existing designs and introducing new lines of current-consuming devices at prices which cannot be said to carry an exorbitant profit. He incurs considerable expense in assisting to secure new customers for the supply station by supplying attractive advertising matter for distribution by local contractors. The central station in many places can co-operate with the manufacturer because it practically occupies a commanding position with regard to the sale of the goods the manufacturer places on the market. It is said by some who have had experience in installation work that the public will accept a statement of the station engineer as to the merits or demerits of any appliance rather than take the word of the contractor.

It has been contended that with this advantage it is not only unnecessary, but ill-advised, for a central station which has equipped a showroom to sell goods to the public at a price below that suggested by the maker in his list as one at which a fair profit can be made. The sale of lamps or fittings at less than list price is regarded by most business men as a confession of weakness on the part of a sales department. Moreover, supply authorities are certain to meet with more or less open opposition on the part of contractors if they adopt the practice of cutting prices. At the present moment there is a good deal of friction in some towns because of the efforts of the I.M.E.A. to promote a Bill for municipal wiring and fittings powers. If municipalities cut prices they are sure to lead some of our contractors who, if not faced with such competition, would supply materials of a good quality, to purchase low-priced inferior goods, impairing the efficiency of an installation. The contractors are not going to let the I.M.E.A. ride rough-shod over their interests. We are not so sure that this is not a case where the municipalities and the wiring contractors, instead of fighting one another, might do better for the progress of electricity supply by a round table meeting at which they could see whether some agreement as to main principles, defining the place of the municipal department in respect of private installation work, could be arrived at.

The St. Clair Tunnel.

A somewhat interesting item of news culled from the columns of our contemporary, *Canada*, refers to the results of two years' working of the St. Clair tunnel by the Grand Trunk Railway, where electrification has apparently reduced the general operating cost to 60 per cent. of its former amount, and similarly, the total cost, including capital charges, to about 85 per cent. of the figure obtaining under steam working.

The St. Clair tunnel was electrified ostensibly in order to escape smoke nuisance, and doubtless the use of expensive anthracite locomotive coal may have had something to do with electric traction's good showing, but as this has been achieved on a road and with traffic conditions which the railway man would presumably—smoke nuisance apart—not hesitate to work by steam on the grounds of cost alone, the result must be more than ordinarily satisfactory to those who believe that the paying sphere of electric traction can be much more widely extended than it is at present.

One cannot, of course, say how far the case of the St. Clair tunnel—where success has largely resulted from reduced fuel cost—may apply to steam lines in this country, but as the railways of the United Kingdom spend annually some 5½ million pounds on locomotive fuel alone, or an average of over 4d. per train-mile run, there is evidently some scope for economies in this direction.

Competition in Germany.

The industrial contest to secure orders is specially keen in Germany at the present time, and this probably explains the apprehensions which have arisen that monopolies are being created in different parts of the country which may exclude competition in the supply of plant and installation material outside of central-station work. Thus in the case of the contract concluded between the Saarbrucken State Mining Authorities and the A.E.G., which, as previously reported, provides for the establishment by the company of a subsidiary distribution company to be supplied from the projected Prussian State pit-bank stations, it has been assumed that the contract confers a monopoly on the A.E.G. for the supply of plant and installations to be connected with the mains of the distribution company. It is, however, now stated, on the one hand, that this is not the case, as the mining authorities have expressly assured themselves in the contract that competition shall be full and free, and have also provided that this condition shall not be evaded. On the other hand, this statement is contradicted in so far that the State Mining Authorities are declared to have no decision of the kind to make, but that this rests solely with the communal authorities which will become customers and is subject to the approval of the State Governor of the district. It is submitted that under any circumstances decisive opposition must be brought against any grant of an installation monopoly, in the interest of the numerous electrical contractors and of consumers in order that prices may not be forced up to a high level, whilst at the same time it is contended that the only decisions which the mining authorities could arrive at on the subject would be in relation to the State mines and any associated land ownership. A second instance where a large station is to be erected is in the Duchy of Gotha, where the State Ministry has entered into an agreement with the A.E.G. to provide a station capable of supplying in the first five years all the communes which require a connection with the distributing mains. It is intended to establish a high-pressure network, and the company has been granted the exclusive right of using the State roads for this purpose. This scheme and that relating to the Saarbrucken district are attacked by a Socialistic newspaper on the ground that the State does not exist to confer a monopoly upon a share company and to assure it high dividends.

The Cost of Providing Means of Escape in Case of Fire.

An interesting question was recently discussed in the Shoreditch County Court as to the apportionment as between landlord and tenant of the cost of providing fire escapes at the bidding of the London County Council. Power to direct such means to be provided was conferred on the Council by the Building Act of 1905. The cost falls on the owner or landlord in the first instance; but he may (by Sec. 20) ask the County Court to declare whether any, and if so what, proportion is payable by the tenant, having regard to the covenants of the lease. In the case in question (Tillard *v.* Epstein, *Law Times*, July 2nd, 1910, page 222) there were certain premises let at a rent of £242 10s. for 21 years, in respect of which the County Council had made an order. In carrying out that order, the owner paid £77 9s. 4d. for the fire escape, £5 5s. 8d. surveyor's fees, and £15 15s. solicitors' costs. He then sought to make the tenant liable. Judge Smyly first of all considered whether the expenses were reasonably incurred. With regard to the surveyor's fees, he said:—"If the landlord did not employ a surveyor, I think it is very likely that he might make some part of the works, if he were a cautious man, far too heavy and strong; and if he were a penurious man, and cut the price too close, it is just possible he would make it inefficiently, and have to do all the work over again." With regard to a sum of £15 15s. which the landlord paid to his solicitors in connection with the matter, the Judge held that this could not be recovered.

The next question was how the liability was to be apportioned. The covenant binding the tenant provided that he should execute all such works as might be ordered to be executed by the landlord or the tenant, by any Act of Parliament whether present or future. As the London Buildings (Amendment) Act, 1905, was not in force when this lease was granted, the judge held that he could not, under this covenant, fix the tenant with the whole liability. But there was a further covenant which, in very stringent terms, imposed upon the tenant liability for all outgoings and assessments in respect of the premises. The question, therefore, was how much the landlord would have to bear. As to this the judge said: "I think I must assume that at the end of the lease the County Council will still have the same powers as were given them by the Act of 1905, and that the fire escape will add to the letting value of the premises as a factory, though not as two separate private houses or even as one private house. Sec. 20 says that I must have regard to the terms of the lease or contract; and, that being so, I have to take into consideration this fact, that the lease or contract is as stiff as it could possibly be made. One cannot read it without seeing that the landlord's solicitors did their best to throw on the tenant any expenses connected with the house, and on the other hand, I think that the defendant must have seen that that was the intention of the landlord. I have felt, therefore, that I must have regard to the stringency of the terms of the contract; that I should not be giving due effect to that unless I allocate as part of the costs payable by the defendant more than what one would in the case where the lease is not so strong." In the event, his Honour directed that the landlord should bear one-fourth, and the tenant three-fourths of the expenses.

Care Pays.

Brooklyn Bridge is the terminus of 17 tramlines, and any delay in the service across the bridge is reflected back all over the city. It was found that the poor condition of the cars was responsible for a great many delays, and a determined effort to minimise failures during the last three years has had an astonishing effect. The engineer in charge of traffic department of bridges, New York City, tells us in the *Electric Railway Journal*, that the delays per 100 cars have been cut down from 49 seconds to 9·9 seconds, and the average time of delay from 4·4 minutes to 2·2 minutes.

The net result is shown by the fact that the number of cars running has been increased by 40 per cent. during the 5 to 6 p.m. rush hour; and the reliability of the service has improved so much that in 1909 the rush hour schedule was operated 82 per cent. of the time, whereas in 1907 it was operated only 4 per cent. of the time.

Improvements of this order of magnitude would very soon pay for the extra cost of supervision and maintenance, and finally might lead to the actual reduction of working costs.

NEW POST OFFICE TELEPHONE EXCHANGE, GLASGOW.

(*Concluded from page* 343.)

The accompanying plan, fig. 17, shows the general arrangement of the Exchange, which possesses the very unusual feature that the whole of the equipment is accommodated on a single floor. The width between the sections varies between 39 and 43 ft., and the total length between sections will eventually be 157½ ft. A partition built up along one line of pillars separates the switch room from the test room. The arrangement is exceptionally convenient and satisfactory.

We have already indicated in general the method adopted for the working of the exchange; it may be interesting to add some details of the principal circuits, which are illustrated in figs. 18, 19 and 20. Fig. 18, a diagram of the transmission system, is a modification of that devised by Mr. J. S. Stone in 1892. The 40-volt common battery is connected to the tip and ring conductors of both sides of the cord circuits *viâ* 200-ohm supervisory relay coils. For transmission purposes the two tips and the two ring conductors of the plugs are connected together by 2-mf. condensers. As we have already pointed out, the presence of high impedances between the battery and the conductors of the cord circuits ensures exceptional freedom from overhearing, and the efficiency of transmission from subscribers' circuits will be at least as efficient as, and more uniform than, with systems using lower voltage.

Figs. 19 and 20 are skeleton diagrams of the subscribers' line and cord circuits.

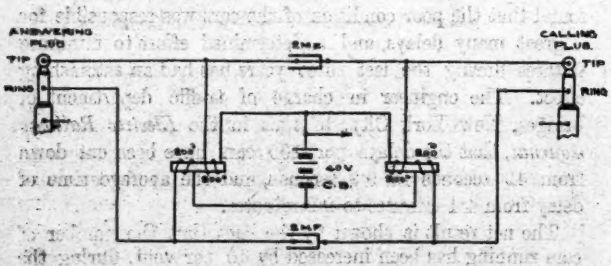


Fig. 18.—Transmission System.

The connections for the subscriber's station are those of the department's standard common-battery instrument. One or two new features will be observed in the subscriber's line circuit—the 40-volt line lamp, naturally most suitable for a 40-volt system, the 50-ohm cut-off relay and the double-coil line relay.

The type of small private branch exchange, or subscriber's intermediate instrument, which requires current to be drawn from the "B" or ring wire of the exchange circuit without interference with calling or supervisory signals, will not be catered for in Glasgow. Hence there is no objection to the presence of a 200-ohm line relay coil between the negative pole of the common battery and the "B" wire of the circuit. The same argument holds good for the cord circuit, where a 200-ohm supervisory relay coil connects the common battery to each "ring" conductor.

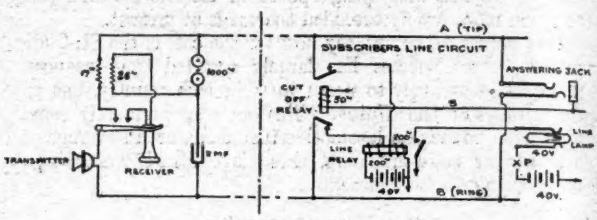


Fig. 19.—Subscriber's Station.

Briefly, the operation of the circuits is as follows:—The removal of the receiver from its rest by the calling subscriber closes the line relay circuit, and the operation of the line relay connects the 40-volt line lamp across the common battery. The line lamp glows, and the operator, noticing the signal, inserts the answering plug of a disengaged cord circuit into the answering jack. Conductors A, B and S of the cord circuit are thereupon connected to the corresponding conductors in the line circuit. The cut-off relay is energised by a current which flows *viâ* the 400-ohm resistance in the cord circuit, and the operation of this relay disconnects the line relay from the calling subscriber's circuit. As the subscriber's receiver is off the rest, the insertion of the answering plug into the answering jack closes the circuit for the answering supervisory relay, with the result that the 36-volt supervisory lamp associated with this relay is disconnected. To take the required subscriber's number the operator throws the speaking key, an action which connects her telephone to the cord circuit. The number of the subscriber required having been ascertained, she places the tip of the calling plug in contact with the socket of the nearest multiple jack of the required subscriber's circuit. If he is already engaged, a current will be flowing through the cut-off relay of this circuit; and since all the multiple jacks, as their designation implies, are in multiple with each other and with the answering jack, a negative potential will exist at all the jack sockets of the engaged circuit. When the speaking key is thrown,

FLOOR PLAN G.P.O. CENTRAL EXCHANGE, GLASGOW.

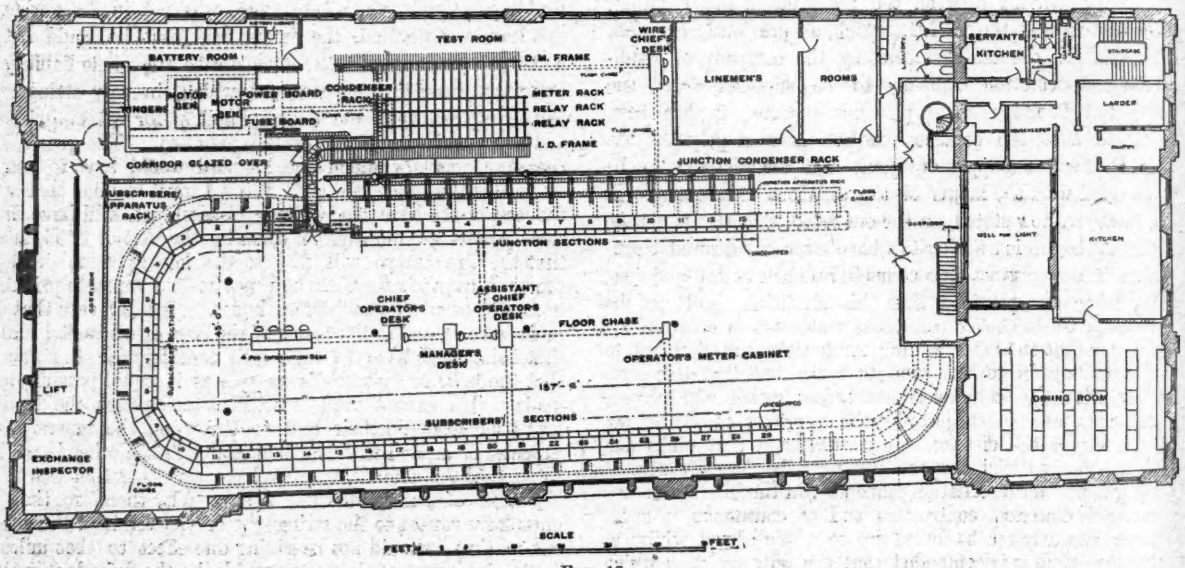


Fig. 17.

the tip of the testing-plug being at zero potential, the charge in condenser K, is a quantity proportional to the whole voltage of the common battery. When, however, the tip of the testing-plug and the socket of the engaged line are brought into contact the voltage across condenser K, is reduced; a discharge follows, the path for which is *via* the operator's receiver, producing an audible click.

Had the required circuit not been engaged, the multiple jack socket would also have been at zero potential, and no click in the operator's receiver would have resulted.

If disengaged, the required subscriber is called by the operator inserting the calling plug into the jack tested and

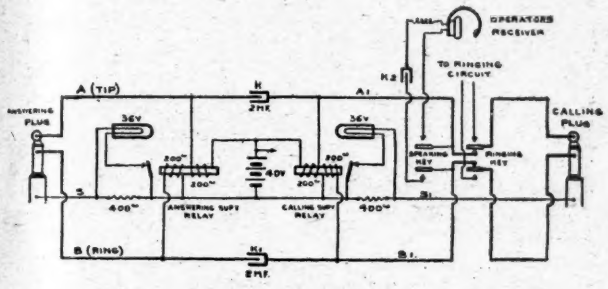


FIG. 20.—SUBSCRIBER'S CORD CIRCUIT.

throwing the ringing key intermittently. The insertion of the calling plug establishes a circuit for the cut-off relay of the required circuit, taking out of action the line relay and line lamp of that circuit. While the ringing proceeds the 36-volt supervisory lamp associated with the calling supervisory relay will glow, there being sufficient voltage across the lamp filament when it is in multiple with the 400-ohm resistance in the cut-off relay circuit. The operator continues to ring intermittently until between the ringing intervals she notices that the supervisory lamp darkens. This indicates that the subscriber required has removed his receiver from its rest, thus closing the circuit for the calling supervisory relay.

The subscribers' circuits are now connected for communication, and while the subscribers are conversing the supervisory lamps are disconnected. Current consumption during conversation is therefore a minimum. The answering supervisory lamp is controlled by the subscriber who originated the call, and the calling supervisory lamp by the called subscriber, providing double supervision as in other up-to-date systems.

The replacement of the receivers at the end of the conversation breaks the circuits of both supervisory relays, and

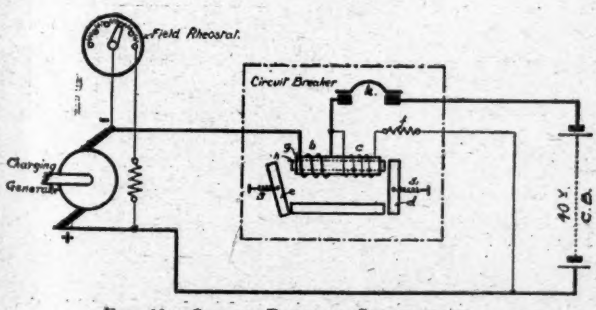


FIG. 21.—CIRCUIT-BREAKER CONNECTIONS.

both lamps glowing, the operator, after depressing the meter key for effective calls, will disconnect the lamp circuits by removing the plugs from the jacks.

We have already mentioned that each charging generator is provided with a circuit-breaker of the "Stanley Edgewise" type, the action of which, being different from that of circuit-breakers hitherto fitted in Post Office telephone exchanges, may not be without interest.

In fig. 21, *h* is the iron core of an electromagnet, *d* the reverse-current armature, *e* the overload armature, *b* the series coil which carries the main current, *c* a high-resistance coil placed in series with a resistance *f* across the mains, and *k* the contacts which are opened when the circuit-breaker operates. Coils *b* and *c* are so wound that when the battery is being charged the flux produced by the current in *c* is in the same direction as that produced by the current in *b*.

The resulting pull upon the armature *d* is sufficient to overcome the action of the spring s_1. With normal charging current in *b*, however, the pull upon the armature *e* is not strong enough to overcome the action of the spring *s*. The mechanism of the circuit-breaker is such that the attraction of the armature *e* or the release of the armature *d* will actuate a tripping device and open the contacts *k*.

If for any reason the generator becomes overloaded, the current in *b* excites the core sufficiently to pull up the armature *e*. On the other hand, the armature *d* is released if the current in coil *b* reverses, as the fields produced in the two coils are then in opposition.

In order to prevent a sudden rush of reversed current demagnetising the core and magnetising it again in the opposite direction before the reverse-current armature has had time to move away, the core is provided with a copper jacket or tube *g* fitting close to the iron. A variation of magnetism in the core sets up induced currents in the tube, which act so as to retard the change producing them. The period during which the core is demagnetised, or nearly so, is therefore increased, and the armature *d* has time to move away.

In conclusion, we wish to express our acknowledgments to the *Post Office Electrical Engineers' Journal* for the excellent description of the Exchange, from which we have extracted the foregoing particulars, and to the manufacturers and installers of the plant—the Peel-Conner Telephone Works, Ltd., of Midland Bank Chambers, Queen Victoria Street, E.C.—for the loan of the half-tone illustrations of the equipment, the extent of which may be gathered from the fact that some 15,000 signal lamps, 30,000 relays, 5,000 miles of wire, 500,000 spring jacks and 3,000,000 soldered connections were required.

RESTRICTED-HOUR SYSTEM OF POWER SUPPLY.

BY P. J. PRINGLE.

(*Concluded from page* 356.)

Two-Rate System v. Restricted-Hour Power System.—The former system while inducing restriction must not be confused with or in any way be compared with the latter. The writer carefully considered the two-rate system before introducing the restricted-hour system, and believed that it could not possibly offer the same advantages.

The two-rate system has a considerable element of risk, as there is no sound provision for ensuring a proper return for the capital charges incurred by the maximum demand of supply. It is a system far less sound than the maximum demand system, or a fixed price per kilowatt of demand with a low price per unit.

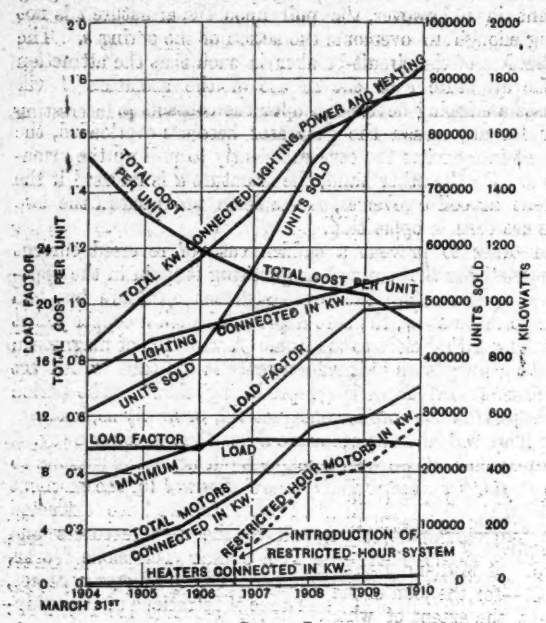
Power consumers on the two-rate system may, in a general way, keep off the high rate hours, but there are times when it is a convenience to come on during these hours, and this can be done at a comparatively small cost to them. This would result in a return to the undertaking quite inadequate to cover the capital charges incurred by their demand. The power user may be busy, and willing to pay two or three times the low power rate for the convenience of working half an hour or more overtime. Presume a 55-H.P. consumer did this for, say, a fortnight before Christmas, and demanded 50 KW. for ¼ hour for each of the 12 working days. This would represent 450 units, and in a two-rate system of 1d., with 3d. for the high rate hours, bring in an additional revenue of 450 units at 2d., or £3 15s. Yet this consumer in all probability would increase the station demand by 50 KW. *Entire restriction should be aimed at, otherwise a consumer must be made to pay his fair proportion of the capital charges incurred by his demand.*

General Advantages of the Restricted-Hour System.—These may be summed up briefly as follows :—

D

(*a*) The increasing of revenue without any increase in capital charges other than the "connecting on" cost.

(*b*) The improvement of the load factor, together with reduced cost of working.



CURVE I.

On examining Curve I the lowness and the constancy of the load factor should be noted previous to the introduction of the restricted-hour system, and how, after its introduction, it immediately took a strong upward movement and continued so.

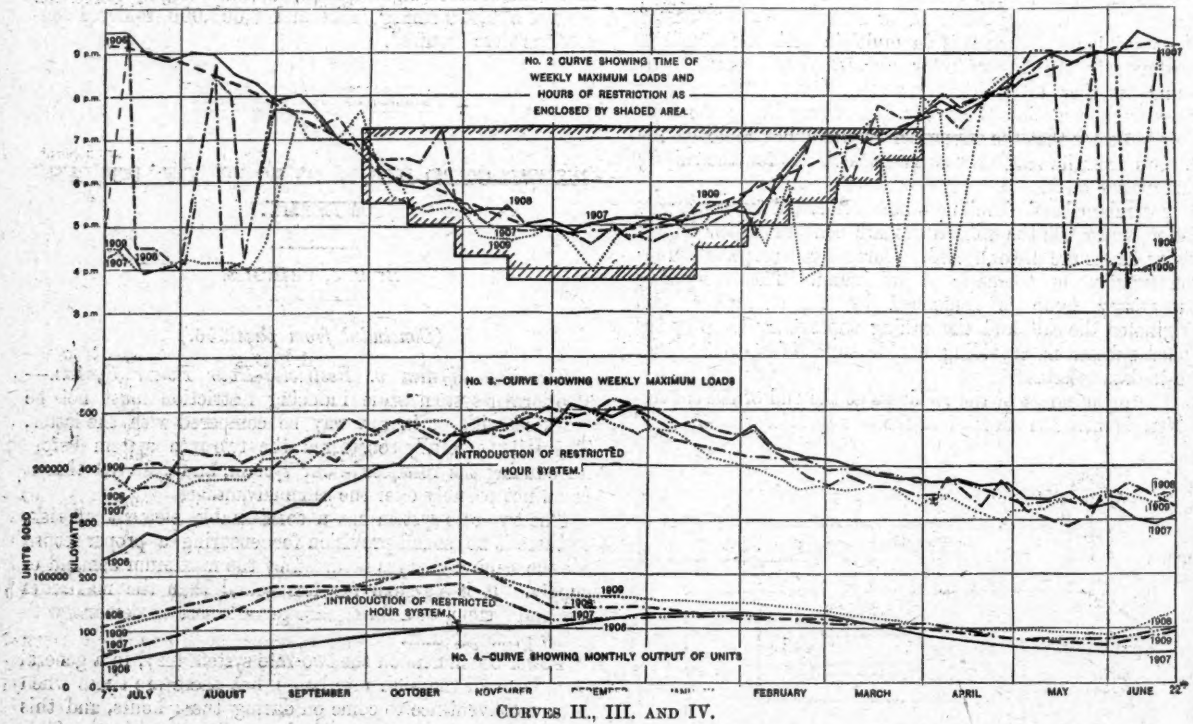
The curve of total KW. connections should be particularly noted in conjunction with the above, and that it has increased year by year at a greater rate since its introduction than before. After its introduction, the load factor which was 9·67 per cent. for the year ending March 31st, 1906, was raised to 19·63 per cent. for the year ending March 31st, 1909, or an increase of 100 per cent. in three years. The curve shows in an interesting manner the yearly rise in maximum demand previous to its introduction, and its constancy afterwards, notwithstanding the KW. connections increasing at a more rapid rate.

It will be noticed that the curve showing the restricted-hour motors connected gradually gets closer to the curve showing the total motors connected. This is due to motors which were running unrestricted being transferred to the restricted class.

Curves II, III and IV show the operation of the system week by week, for a period of the last 4 years.

Referring to Curve II, the times of maximum loads show considerable variation during the summer months. Sometimes it is due to motor load, and occurs between 4 and 5 p.m.; at other times it is due to lighting, and occurs between 7 and 9 p.m.

It will be noticed that the times of maximum loads during



CURVES II., III. AND IV.

(*c*) Demands can be obtained which would be impossible with the ordinary power supply rates, owing to the low price that can be quoted.

(*d*) The constant call for fresh plant and increased capital charges (which has the effect of keeping so many undertakings in a doubtful or stagnant financial position) may be considerably retarded and progressed at a slower rate.

(*e*) At the prevailing power prices in vogue, there are always a certain number of consumers who create a loss.

The restricted-hour system has no element of risk, the rate of profit can be closely estimated, and all consumers contribute at about an equal rate.

Effect of the System on the Burton-on-Trent Undertaking.—The curves attached show very clearly the general effect of the introduction of the restricted-hour system. They deal with the alternating-current supply only, and do not include the direct-current supply, which is used for tramway purposes only.

the restricted months of October to March occur within the restricted hours (shown by the shaded area), and that they fairly closely follow the hours of lighting-up time (one hour after sunset) making allowances for dark and foggy days.

In all three curves the curve shown from July, 1906, to October, 1906, is for a period previous to the introducing of the restricted-hour system.

Curve III shows the weekly maximum loads, and it will be seen how the summer maximums, together with the weekly output in units shown in Curve IV, have been increased. The low places in the load curve have been very valuably filled up, and the margin of KW. available for disposal on the restricted-hour system nearly used up. The metallic-filament lamp has, of course, affected the maximum loads, but as we have just about arrived at the end of their depressing effect, future increases in lighting connections will

TABLE IV.

Year ended March 31st	1903-4.	1904-5.	1905-6.	1906-7.	1907-8.	1908-9.
Lighting units sold	278,289	292,602	313,254	311,899	336,805	318,319
Motor " "	36,904	74,806	103,100	260,601	412,384	548,549
Total of above ...	315,193	367,408	416,354	572,500	749,189	866,868
Motors connected during year, in KW.	Dec. '02-03 11·5	Dec. '03-04 44·0	Dec. '04-05 62·5	Dec. '05-06 169	Dec. '06-07 190	Dec. '07-08. 62
Lighting do., in KW.	48	100·0	86·0	41	47	68
Max. load, KW. ...	370	427	492	511	515	504
Load factor for light'g and motor supply	9·73%	9·84%	9·67%	12·7%	16·6%	19·6%
Per cent. increase in load factor ...	—	+1·13	—1·7	+31·4	+30·7	+18·07

Restricted-hour system of power supply commenced November, 1906. The KW. connections are shown from December 31st to December 31st in each year, as the peak load occurs during this month. The 1909-10 figures are:—Motor units sold, 560,604; total sold, 862,568; motors connected during year, 102·8 KW.; max. load, 500 KW.; load factor, lighting and motor supply, 19·7 per cent.

permit of a proportionate increase in this available margin.

It will be noticed that several of the summer months show a considerably greater output than the winter months, which must obviously help to improve the economy of working.

Table IV.—This gives the principal figures affected by the introduction of this system. The first three years were previous to its use, which I will call the first period, and the latter three after its use, or the second period.

It shows in an interesting manner that for the first period, notwithstanding comparatively large increases in the motor units, the load factor remained practically constant, but that during the second period it went rapidly ahead until now it is almost equal to our traction load factor, which is 20·12 per cent.

Our lighting load factor has always been a low one, and perhaps the above result may be rather an extreme case. I, however, feel sure that much of the unrestricted motor load which is accepted to-day is not raising the load factor in the way it should, to properly justify the low prices that it is sold at.

The days when lighting units were the mainstay of the undertaking have gone, consequently this point assumes far greater importance that it did.

During the second period, 421 KW. in motor connections and 153 KW. in lighting connections have been made, yet the maximum demand has only increased 7 KW.

This rather extraordinary result has been obtained owing to the following facts:—All but 10 per cent. of this additional motor load is restricted, and over 200 H.P. which was previously unrestricted and was known to overlap the lighting peak, was transferred to restriction. In addition, the introduction of metallic-filament lamps has, of course, lowered the maximum demand.

The new lighting connections given above are, however, mainly metallic-filament lamps, so no reduction in KW. demand has to be made on their account.

For the year ending March, 1909, the total horse-power in motors connected was 777·5 with 546·75 H.P. restricted. At the time of writing this article there are 150 motors connected amounting to 955 H.P., with the very large proportion of these, viz., 90 motors of 766¼ H.P., restricted, or 80 per cent. A further 83 H.P. is shortly to be connected, of which 57 H.P. will be restricted.

The energy sold on the restricted-hour system for the year ending March, 1909, amounted to 427,014 units, with a revenue of £1,515, and represented 78 per cent. of all the units sold for motor purposes. Curve I has been continued to show the figures to March, 1910. From this it will be seen that a further 155 KW. in motor and lighting connections have been made with no increase in the maximum load. The output remained almost stationary. This was due to a 5 per cent. drop in lighting, with an increase in motor units which little more than balanced this. Local trade depression accounted to a great extent for these results. Notwithstanding the above, the total cost per unit curve has been considerably lowered.

The average price of the restricted-hour unit was ·842d. and, for all the motor units sold was ·96d. More than two years ago we should, in the ordinary way, have had to incur extensions of generating plant. Instead of this, we have doubled our output, so that practically every £1 of capital expended on plant and mains is now producing double the number of units, and our capital expenditure, other than that incurred by the ordinary connecting on of consumers, has remained constant.

There are very few undertakings which have introduced this system, and the majority of them are mentioned below. The particulars I have been favoured with will be interesting, as showing the procedure adopted in other towns and the progress made:—

MR. T. ROLES, of Bradford.—"Out of a total of 6,557 B.H.P. of motors connected to our supply, excluding those in use by bulk supply consumers, 709 H.P. are supplied on the restricted-hour system, which is 10·8 per cent. of the total.

"The price is a flat rate of ¾d. per unit. A similar system is in operation for lighting supply, the price in this case being a flat rate of 2d. per unit.

"The hours of restriction, both in the case of motor and lighting supply, are between 4 p.m. and 6 p.m. during the months of October to February, inclusive. An approximate rental of 10s. per annum is charged for time switches.

"The restricted-hour consumers include a 120-H.P. cold stores, the remainder being principally hay and straw merchants, joiners, builders and contractors (for mortar mills, &c.), and engineers and millwrights.

"I find that to the textile trade generally the restricted-hour system is of little benefit; neither does it seem to appeal, as a rule, to factories and workshops where a number of workmen are employed during the trade union hours in the winter months."

MR. J. CHRISTIE, of Brighton.—"Out of over 2,500 H.P. of motors connected, 2,000 H.P. are connected on the restricted-hour system. The price is 1d. per unit, and discounts are given up to 10 per cent. to consumers who use 450 units per quarter per horse-power installed. For large consumers a sliding scale reduces the price down to a little under ·8d. per unit.

"In Brighton the conditions differ considerably from those in the majority of towns. We are immune from fogs, and our lighting peak always comes on later than 5.30 p.m. The restricted-hour scheme has undoubtedly been a great success, and the increased output which we have obtained from this source has helped us to very materially economise in our works costs and to improve the position of our undertaking generally."

MR. R. H. CAMPION, of Dewsbury.—"We have 12 consumers with 190 H.P. on the restricted-hour system, out of a total of 560 H.P. connected. The price per unit is 1d., and the hours of restriction vary from 3.30 p.m. to 6 p.m. according to season from September to March (no restrictions on Tuesdays and Sundays). The restricted-hour consumers take 42 per cent. of the total units supplied for power. This system has certainly been a success here, and on the whole we have had few complaints as to switching off. The charges for time switches for motors up to 5 H.P. are £2; 5 to 10 H.P., £2 10s.; 10 to 20 H.P., £3; above 20 H.P., £4 per annum."

MR. W. W. LACKIE, of Glasgow.—"The total horse-power connected on our mains is 32,000 H.P. and 2,160 H.P. is on the restricted-hour system. The latter demand is divided up amongst 145 consumers, these being principally butchers and bakers. The hours of restriction during the winter months are 3.30 p.m. to 6 p.m., the price per unit being 1d."

MR. W. A. VIGNOLES, of Grimsby.—"We have 32 motors aggregating 395 H.P. on the restricted-hour system out of about 1,550 H.P. connected. The price per unit is 1d., less 5 per cent., and a discount of 2½ per cent. is given for cash in one month. A minimum charge of 9s. per month is made for any quantity up to 50 units. The hours of restriction are as follows:—

From September 15th to 30th ...	From	6.30	to 9.0 p.m.
" October 1st to 15th	"	6.0	" "
" " 15th to 31st ...	"	5.30	" "
" November 1st to 15th ...	"	5.0	" "
" " 15th to January 10th	"	4.30	" "
Christmas week	"	4.0	" "
January 10th to February 10th ...	"	5.0	" "
February 10th to March 10th ...	"	6.0	" "
March 10th to March 31st ...	"	6.30	"

"Supply is available at any time during the summer months." The charges for time switches are the same as at Dewsbury.

Mr. C. M. Shaw, of Worcester.—"We have 900 H.P. of motors connected in Worcester, of which 170½ is on the restricted-hour rate, for which our charges are 1d. per unit for continuous running and 1¼d. per unit for intermittent running. The hours of restriction are from dark to 8 p.m. from November 1st to February 28th inclusive."

I hope that these notes will prove that the restricted-hour system of power supply is a thoroughly practical one, and that they will lead to an extension of its use. Such a procedure must result in an expansion of output and revenue, and the strengthening of the financial position of those undertakings introducing it.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Lightning Conductors.

"The suggestion that the bending of a conductor to the outline of a building constitutes a source of inefficiency is one that I have challenged on many occasions, but no one has put forward any theoretical considerations, experimental proof or practical results to show that an abrupt bend in a conductor tends to increase liability to side flash." These words were written by Mr. Alfred Hands in a letter dated July 8th, and published in the Electrical Review, July 15th, 1910; his case is stated, I think, with remarkable clearness.

A solution to the controversy of whether a sharp bend in a conductor increases or decreases inductance would be of great importance to all those responsible for the provision and inspection of lightning conductors, and it is to be regretted that discussion upon the subject invariably generates more heat than light.

There is always something to be said on both sides of every question, and nothing is settled by scoring a dialectical advantage over an opponent.

I am not sure that Mr. Killingworth Hedges intended his letter of the 15th inst. to be regarded as an answer to the point at issue, since his object in writing was not to enter into the discussion about the zig-zag question. Nevertheless, that gentleman quotes three Continental authorities, one of whom asserts that "lightning finds no great difficulty in making its way . . . *through the air or through any other good conducting medium*," thus implying that air is a good conducting medium.

The doubtful value of this quotation reminds me of an equally incorrect statement made by another Continental authority:—

"It is better for any building, factories in particular, to be without any lightning conductors at all than to be fitted with such as are defective or badly planned."

Many of your readers, like myself, would appreciate a pronouncement from an English authority like Sir Oliver Lodge, F.R.S., concerning the precise effect of abrupt bends in a conductor. That distinguished scientist has devoted an immense amount of time and thought to the question, and, unless I am mistaken, his views as to the anti-inductance effect of a zig-zag are directly opposed to those generally held.

Mr. Hedges's advocacy of iron conductors may have much to recommend it from an electrical point of view, but the opposition to their introduction is almost as pronounced as ever. In the discussion following Sir Oliver Lodge's paper before the Institution of Electrical Engineers, the late Lord Kelvin said: "I would take these galvanised-iron wires—and the more of them the better—down all the corners and wherever they can be got, and connect every one of them to a water pipe. I would connect all pieces of metal to each other and to a water main if the latter is available; if not, connect them to the lightning conductor and give *it* a good earth."

It happens, however, that the majority of engineers and architects, without questioning the accuracy of his Lordship's opinions, not unreasonably object to the disfigurement of stone tracery and other portions of architectural ornamentation by the presence of a mesh of iron wires which, in a few years' time, would be sufficiently oxidised to require renewal.

My own experience with telegraph wires may be not undeserving of notice. In most of the manufacturing towns of Lancashire a galvanised-iron wire—No. 8 gauge—used for aerial telegraphs, will last from five to eight years, whilst a 12½ gauge hard-drawn copper wire erected in the same locality will not require renewing until 15 or 20 years have elapsed.

J. H. Runnett.

Bolton, *August 27th*, 1910.

Knowledge as to whether abrupt bends do, or do not, increase inductance is, I believe, dependent on analogical reasoning, experimental research and mathematical data, and not on the observed effects of lightning. It is not even a matter dependent on lightning or lightning conductors. Therefore, if Mr. Hedges's letter is intended in support of the view that inductance is increased thereby, it is strange that he has only been able to quote opinions of foreign scientists. Even though these quotations have been strengthened somewhat by omissions, they are merely statements unsupported by explanations as to the data on which they are based, and they may not be better founded than views expressed with similar bareness in this country.

The German recommendation, that conductors should be led to the ground by the most direct route, avoiding *as much as possible* all sharp curves, does not say that increased inductance would be the objection, and is probably based on Sir Oliver Lodge's experiments, showing that if a discharge is given a course round a large loop with the ends brought fairly close together, it is apt to spark across the air-gap. These experiments are, I think, scarcely comparable to true side-flash effects in lightning conductors.

The same may be said of the Dutch statement that lightning prefers to move, *as far as possible*, in a straight line, and that sharp turns *or spiral windings* in conductors present hindrances, but I may add that lightning never has moved in a straight line except when controlled by artificial agency, and perhaps I am warranted in saying that it never will. It is, I think, generally agreed that spiral windings *do* increase inductance, but if Dr. D. van Gulik intends his remark to apply to other bends than those of a spiral nature, I do not think we are obliged to accept it as necessarily more convincing than his reference to the air as a good conducting medium.

Dr. M. von Hoor's comment on the method adopted in Hungary when setting up cage conductors, special care being taken to avoid the sharp curves arising from a sudden change in the direction *of the earth conductors* so as to reduce *as far as possible the* self-induction *of the earth connection*, may, or may not, be properly translated. It is, however, a personal communication to the Lightning Research Committee and was published under its auspices. The incorrectness in other respects of this Committee's report would, I think, justify one in accepting this quotation with some reserve, even if its peculiar wording did not raise a doubt. I have italicised words omitted in Mr. Hedges's quotations.

Mr. Hedges's reference to iron conductors that have been in existence for four years without rusting is not conclusive evidence of the durability of iron in this climate. It is probably true that iron conductors would last as long as the other exposed ironwork on buildings, but everyone familiar with the subject is aware that vanes and other ironwork in positions not accessible for periodical painting get into a deplorable condition.

Lightning conductors are expected to last a very long time, and the experience of a few years is no guide as to durability. I have in my possession pieces of what Mr. Hedges would probably call "perishable" copper conductors from buildings protected by Sir Wm. Snow Harris about the time of the Crimean War, yet during the half-century's exposure to the weather the metal had not deteriorated to an appreciable extent. They have been replaced only because

it was found cheaper to renew than to re-apply on the altered plan rendered necessary by changed conditions.

The Research Committee stated that iron "unfortunately oxidises rapidly in towns and smoky districts," and recommends copper for conductors in relatively inaccessible positions. Sir Oliver Lodge, who has been an advocate of iron, recently recommended copper for structures, the efficient protection of which he regarded as of importance. Although these were situated in what is probably as pure air as any in England, he had doubts as to the durability of iron. I may also quote Mr. Killingworth Hedges :—"The practice in the United States is to fix iron rods which quickly become corroded at point of entry into ground." "Lightning conductors are costly to renew; iron perishes quickly, copper very slowly; therefore use the latter."

Alfred Hands.

London, E.C., *August 29th*, 1910.

Proposed Institution of Consulting Engineers.

Referring to your remarks on my letter, which you were kind enough to publish in your current issue, may I be permitted to state that I have never intentionally suggested "that theoretical knowledge is acquired or conferred by examination," and I fail to see how anyone reading my letters carefully with an open mind could interpret such an idea. I did state, however, that "if theoretical knowledge is essential," there must be an examination qualification for the proof of such knowledge. May I ask, Mr. Editor, in what other way it is possible to prove theoretical knowledge, or "knowledge of theory," which you seem to suggest is a higher qualification.

As stated in your columns of July 22nd when dealing with the meeting for discussing the formation of the proposed Institution of Consulting Engineers, "All the speeches that were made were all to the same effect, viz., that it was highly desirable to form an Association of Consulting Engineers, which it was hoped—to use the words of the hon. sec.—would result in giving the public the same safeguards as they now have when they retain the services of a solicitor or doctor." I quite agree that to make such an object a complete success, suitable legislation must, of necessity, be introduced, but may I point out that the proof of knowledge by examination is necessary in both the above-mentioned professions.

If theoretical knowledge is essential for a competent consulting engineer, how will the final object of the proposed Institution be attained if theoretical knowledge is going to be assumed in place of the examination qualification required in the other two professions?

I do not dispute that there are men unable to pass exams. who know more than some of those who do pass, but that is their fault or misfortune, as the case may be, for not being able to pass the only practicable test of knowledge, viz., the examination.

Harold Curry, A.M.Inst.C.E., A.M.I.E.E.

August 27th, 1910.

[For a budding engineer, or a medical student, an examination is, no doubt, an excellent thing; but that is not the question. A consulting engineer should be a man of ripe knowledge and experience, and to subject him to examination would be intolerable. No man should aspire to the title who has not carried out such work as will of itself bear witness to his ability—and that, in our opinion, is the proper test. The tree is known by its fruits.—EDS. E.R.]

Since following the discussion in your columns, I cannot refrain from expressing my disgust for the compressed and biased conformation of the proposed articles.

To my mind, "civil engineering," as at present practised and understood, is now far more removed in importance from the general heading "engineering" than it was about 1820. At that time, engineering of any kind was very cognate indeed, and the two terms were even then scarcely necessary; however, surveying engineers of that time claimed differentiation necessary, and accordingly instituted the title civil engineer.

Since then, however, applied science and invention have only really awakened, and with the stupendous strides "engineering" has made to date, it has become much more necessary to institute further titles under the universal heading "engineering," than the two former representations of that noble profession of the applied sciences. Consequently we now have at least seven separate types of engineering falling each directly under the general heading, "engineering," chief of which, at the present day, is mechanical engineering, followed in close succession (for importance only) by naval, electrical, and so on, more or less shadowing to a degree either of the former two headings.

Many of these branches under the comprehensive heading, "Engineering," have built up their own institutions, and are rapidly bringing these to the high position that each profession justifies. This, however, can only be done in time, and a glance at the constitution of the Institutions of the younger but more powerful actual branches of engineering should dispel all thought of where the 1820 rating of engineers ends.

Now, however, that there are so many titles coming directly under the supreme heading "Engineering," it would almost suggest that an Institution of Engineers should be formed, whereby only eminent engineers in the different branches could qualify for election. These eminent engineers only could be certified as qualified consulting engineers in their own particular branch. In this way the public would be afforded the choice of a really experienced and technically trained adviser in any branch of engineering.

As for the present proposed Association of Consulting Engineers, it would appear from the unwholesome pandering to the Institution of Civil Engineers, that this Association as now formed merely represents a clique of the Civil Engineers who anticipate an Institution of Engineers on the above lines and wish to forestall themselves against having to take a back seat through not having the qualifications necessary for election, also to endow members of the Institution of Civil Engineers with the sole right of practising as qualified consulting engineers, and at the same time afford them the use of an advertising medium (in the public list of members) similar to that of the "Patent Agents," or, in other words, an association for affording the consulting brethren of the Institution of Civil Engineers a "lusty battle axe" for the purpose of usurping this standing and clefting any possibility of a truly eminent Institution of Engineers.

A Royal Institution of Engineers, or something of that sort, worked on square lines and incorporating eminent engineers of the various branches, would undoubtedly receive general approval. Certain qualifications could be made, but not essentially I.C.E.

What about D.Sc., B.Sc. and other equally qualified men who would not think of submitting themselves to the fickle scrutiny of the Council of the Civils, not to mention the money thrown away in membership?

The I.C.E. is quite good in its own branch, but it is no hall-mark of experience.

B.Sc., &c.

More Injustice.

Might I, also a "Poor Unfortunate," say a few words about the injustice to station assistants? I served over three years in the workshops of one of the largest electrical engineering firms, at the same time attending a technical school and reading up at home. I was then lucky enough to obtain a post as junior assistant at a large central station, where I had a first-class experience with steam and oil engines, boilers, &c., three-phase E.H.T., three-wire D.C., and tramway work. What I was worth may be judged from the fact that in under 18 months I rose from junior assistant to senior assistant, also undertaking the duties of station superintendent, and, in the absence of the chief, having full charge of station plant and staff.

Then came the injustice I complain of. The chief obtained a better post, and a new chief was appointed. My old chief gave me a first-class testimonial, when after working *one* day only for the newly-appointed chief I was told by him that the station could not support a station superintendent, and that I must accept a reduced salary; which was, in other words, asking me to hand in my resignation. The true reason of this was that, being a new man, the chief was anxious to show the directors how he could reduce the costs of the station, and so I had to suffer. After being

out of work some months I have been forced, owing to shortage of cash, to accept a post as shift engineer in a tramway sub-station; which means that, owing to no fault of my own, I have come down the ladder instead of going up.

I might add that my place has been taken by a shift engineer at a less salary, and a new pupil is taking full charge of a shift. Is it not very doubtful whether allowing an inexperienced pupil to run a station will reduce the expenses?

Another Poor Unfortunate.

Electricians' Employment Bureau.

My experience with a certain Engineers' Employment Agency may be of interest to "A Subscriber," and others.

I was enrolled, and paid the subscription to this agency in September, 1908. In October I wrote and received a reply to the effect that, "trade being bad, rendered it impossible to get any situations to offer me."

Since then I have neither heard from them, nor have I seen their advertisement displayed.

Alsohad.

I am glad to see that others have given their experience regarding a certain Electricians' Union, and no doubt there are a good many more who have been treated in a similar way, and unless my subscription is returned with references at once, I intend to put the matter in a solicitor's hands and make an example of them.

I might mention that some few months ago the same Electricians' Union had an advertisement in the paper advising intending subscribers to look out for a special announcement, but, strange to say, although a constant reader, I have not seen anything yet. I am afraid the special announcement has got to come, but not the one they would like to see.

A Subscriber.

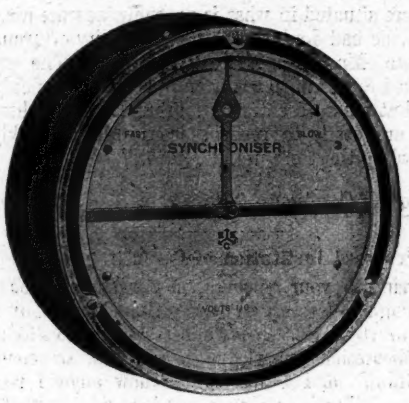
The Synchronising of Alternators.

In his quest after "simplicity," the contributor of the article under the above heading in your issue of August 19th seems to have overlooked the fact that the modern rotary synchroniser is probably about as simple a contrivance as it is possible to conceive. For example, the instrument illustrated herewith consists merely of two fixed coils and a Z-shaped piece of iron carrying a pointer and running between centres. There is in such an apparatus far less to go wrong than in the glow lamp even, which your contributor seems to favour, whilst admitting that it should preferably be duplicated, seeing that "the failure of the filament at the critical instant might lead to mistake."

Your contributor's reasoning is somewhat difficult to follow. For example, he says of the rotary synchroniser that "its movements when synchronism is nearly reached are slow and unsteady," whilst in the next paragraph he expresses the opinion that this same instrument is quite unnecessarily exact for modern requirements. We hardly know which of these two conflicting views is the most at variance with everyday experience, but, as far as we have been able to discover, no one who has once used an up-to-date rotary synchroniser is at all anxious to return to your contributor's "simple contrivance," in fact, it is the "simple contrivance" which usually falls into disuse.

Even the more elaborate three-lamp arrangement which he advocates is more or less of a makeshift, in which the direction of rotation of the light replaces, in a vague sort of way, the definite rotation of the pointer in the rotary synchroniser, and the determination of the exact moment of synchronism is left entirely to the judgment of the operator. Besides this, the arrangement has the somewhat serious drawback, as regards expense, of necessitating six transformers to operate it as compared with the two transformers which are all that are required by the rotary synchroniser. Such a device, moreover, is only applicable to a three-phase plant, whereas the synchroniser can be equally well used on single, two, or three-phase systems.

Your contributor further expresses the opinion that "the rotary instrument is a mystery, the inner workings of which are beyond the comprehension of the non-technical man." Whether, apart from all other considerations, it can be considered advisable to leave an expensive installation to the tender mercies of a "non-technical man," may be a debatable point, but even the least technical can hardly fail to understand the use of the synchroniser. Could anything well be simpler, in fact, than an instrument in which a



pointer rotates in one direction if the incoming machine is too slow, and in the other if it is too fast, and in which, moreover, the exact moment of synchronism is shown by the pointer coming to a vertical position? No greater mental effort is called for in its use than that necessary to determine when the hands of the switchboard attendant's watch indicate 12 o'clock. (It is noticeable that even the least experienced members of the staff appear able to determine when this is the case with considerable ease; more particularly so should this happen to "synchronise" with the dinner hour.)

With your contributor's remarks as to the inadvisability of working synchronising lamps from the same transformers as the voltmeters, we are in entire agreement; but here, again, the advantage is all in favour of the rotary synchroniser, since the instrument illustrated only requires some 10 watts for its operation, whereas a synchronising lamp cannot well take less than from 30 to 40 watts. For this reason a well-designed rotary synchroniser *can* be worked off voltmeter transformers if required, whereas a synchronising lamp *cannot*.

Everett, Edgcumbe & Co., Ltd.

Westminster, *August 23rd*, 1910.

Coasting Clocks.

We notice, from your leaderette of last week, that you are still inclined to advocate the use of time meters even in preference to the ampere-hour meters, which have proved so much more suitable to our conditions.

As you probably know, time meters have been tried here on a good many systems, but, in nearly all cases, have been discarded for the very reason which the Americans seem to consider desirable, namely, that the men try to get a too rapid acceleration, with the result that the motors get burnt out. We think you will admit that this is a serious objection, and it is one which we have not heard satisfactorily explained away.

The American system of registering coasting time *only* does not seem to possess any particular advantage over the original arrangement, and it certainly renders the device much more complicated.

The trend of opinion among tramway managers in England is emphatically towards ampere-hour meters, and out of nearly 60 towns now using car meters, over 50 have definitely settled on ampere-hour meters, whilst most of the small remainder are keeping to the older idea of watt-hour meters.

For **Venner & Co.,**

Ernest E. Sharp, *Manager*

London, S.W., *August 30th*, 1910.

Design of Electric Cooking Apparatus.

I have read the correspondence appearing in the *Electrical Times* under the above heading, but think that "Iconoclast" is somewhat hard on the manufacturer.

As with every other piece of electrical apparatus, there is, no doubt, room for improvement, but numerous, almost insurmountable, difficulties are in the way of rapid progress, principal amongst which is the want of co-operation between the maker or designer and the distributor of his products. I think, if "Iconoclast" had only gone into the matter carefully with the makers of the particular apparatus he condemns so strongly, and worked in conjunction with them, he would have got what he wanted.

This, I think, is the crux of the whole question of domestic appliances, as distinguished from scientific apparatus. The manufacturer in this country does not come sufficiently in direct contact with the consumer or user of his apparatus. His information is generally obtained second hand, or through channels which make out to him a case somewhat on the lines of a legal authority, without sympathy. When the manufacturer does get into contact with the actual user of his appliances, ten minutes or a quarter of an hour's talk gives him more information than hundreds of letters and secondhand opinions on the subject.

The purveyor of electrical manufactures is generally very jealous of allowing the manufacturer to communicate at all with any of his customers or users of his appliances, which in itself naturally places the latter at a great disadvantage.

Reference has been made to the gas oven. Now I am acquainted with the gas stove manufacturers of this country, and know fairly well the difficulties they have had to contend with; they, however, had very considerable help from the gas companies and others, which enabled them to bring out a serviceable article; this co-operation was the means of enabling the gas stove makers to put down plant, large companies were formed, and thousands of pounds spent on designs and patterns, which could only be paid for by large sales.

The electrical manufacturer has encountered far greater difficulties, and has been encouraged with very little support indeed from the various sellers of electricity; in fact until a few months ago it was necessary to employ a staff, whose chief duties were to persuade the latter community that electric heating and cooking apparatus was worthy of serious consideration at all.

This, in itself, has been a very difficult matter. Then when the supply companies find that metal-filament lamps are reducing their immediate revenue to a rather alarming extent, they instantly rush to the manufacturer of heating apparatus and expect him to be ready, at a moment's notice, with a thoroughly serviceable apparatus designed on the lines of gas cookers; if he fails to do this he is soundly abused for not being up to date, &c.

This is all very well, but it should be borne in mind that the design of electrical heating apparatus, and particularly cooking stoves, requires infinitely more careful thought, experimenting and research than gas cooking apparatus. A gas cooker really employs only three trades, viz., iron foundry, tin smiths and vitreous enamelling. The electric stove has the problem of insulation at high temperatures to contend with, economy in transmission of heat to the vessels, and a dozen or two other incidentals. The manufacture of the gas stove cannot be compared with it.

I do not think it will ever be possible to manufacture an electric cooking stove at the same cost as the gas cooking stove for the same capacity, but the question of prices raised by your correspondent is almost entirely one of quantity. The gas stove manufacturer gets orders for 500 or 1,000 stoves at a time, whereas the electrical manufacturer is asked to quote for a dozen, or perhaps 20, and thinks himself lucky if he gets an order for one, which he is then expected to do at the same price as the 20. The small quantities asked for often do not pay for the cost of draughtsmen's salaries, organisation, &c., which must be incurred before a single article is sold.

The company I am associated with have recently had some considerable encouragement, enabling them to launch out and spend money on the design of a cast-iron cooking stove on somewhat similar lines to a gas stove. The cooker comprises a large cast-iron structure oven with heavy lagging all round to provide against loss of heat, interior of oven with enamelled linings like a gas stove, and having removable replaceable heaters throughout, without necessitating the taking down of any part of the structure. On the top of the oven is the hot plate for boiling vessels and grilling, composed of two circular ring heaters, and one oblong grill, all replaceable, and a chamber underneath these, over the top of the oven, for keeping food warm.

A fact that I think should not be lost sight of is that the electric kettle or water boiler, of any description, is a kettle plus a stove; yet there are some people who think the electric kettle should come out about the cost of an ordinary copper kettle, produced by the thousand.

An attempt was made to comply with a special request to construct cheaper apparatus somewhat on the lines of oil cookers. These appliances gave very efficient results regarding consumption of current, and cooked very well, but they have not the scope of a gas cooker, nor were they ever intended to fill that *rôle*. Such appliances, however, had the advantage of being used on a table or stand, and were easily portable. The demand now is for heavy permanent structures like gas cookers.

If the sellers of current will back up the manufacturers by supplying current at an extremely low rate, and assist by explaining (not abusing) where the apparatus fails or can be improved upon, we will do all in our power to follow up suggestions and come forward with the design of suitable electrical cooking apparatus.

Chas. H. Archer.

Manchester, *August 22nd*, 1910.

[Mr. Archer addressed the foregoing letter to us at the same time as to our contemporary, in which also this subject has been under discussion.—EDS. E.R.]

Loose-Leaf Books.

The writer has recently been interested in loose-leaf books for meter reading, and they have been adopted here as an experiment.

I should be pleased to learn if any of your readers have experience of this class of book for the purpose indicated, and, if so, whether they have been found successful.

J. S. Bousfield.

Margate, *August 19th*, 1910.

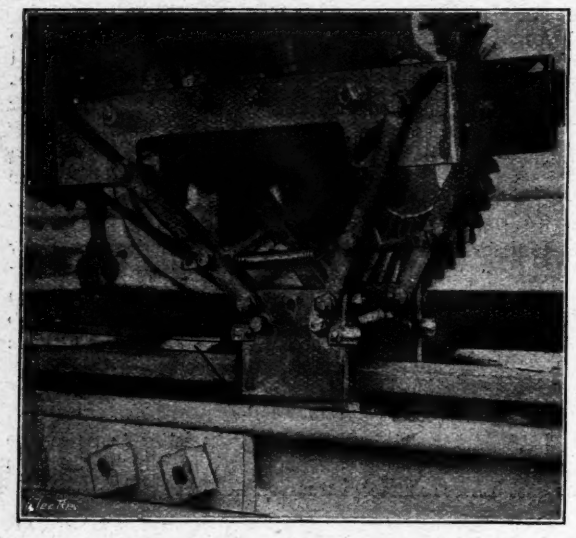
[An article on this subject appeared in our issue of January 1st, 1909, and was followed by correspondence.—EDS. E.R.]

A New German Trust.—The recently reported intention of the BERGMANN ELECTRICITY WORKS CO., of Berlin, to form a financial trust has now so far matured that the undertaking has just been registered with a share capital of £600,000 under the title of the Bergmann Electricity Enterprises Co., the former taking over £295,000 of the shares, Justizrat Rosenthal £150,000, and Fritz Bartmann £150,000. The new company takes over such of the departments hitherto carried on by the parent company as relate to the construction of electric railways, towns and overland central stations, &c., for its own account or for third parties, together with the acquisition of concessions for the industrial utilisation of electric power, the acquisition or financing of undertakings of this kind, especially shares, bonds, various rights and debentures, in order to obtain a dominating influence in the enterprises. For this purpose the Bergmann Electricity Works Co. undertakes to leave to the new company all such schemes, concessions, participations, &c., in return for reimbursement of cash expenses or prime costs, and all drawings and preliminary works for permanent use in case of being taken over, and also to grant to the new company for five years the preferential right to the acquisition of the parent company's shareholding in the Bavarian Overland Central Station Co. at the cost price.

Pattern-Makers' Dispute at Preston.—A correspondent writes:—"A new enterprise at the large establishment of MESSRS. DICK, KERR & CO., of Preston, has had curious consequences. On August 25th 90 pattern-makers of Preston came out on strike, their notices following a demand for a 2s. per week advance in wages having expired. It appears that some time ago Messrs. Dick, Kerr & Co. embarked upon a new enterprise in the construction of steam turbines. To enable them to cope with any orders, they decided to make all their standard patterns at once, and for this purpose engaged between 60 and 70 pattern-makers. It is stated that the pattern-makers, taking advantage of this abnormal demand for labour, asked for an increase of 2s. per week. The masters were unable to concede the demand, and the notices served by the men have expired. One of the masters states that the only possible reason for the men's application was the abnormal position created by the new industry at Messrs. Dick, Kerr & Co.'s works. He contended that the state of trade generally did not warrant any increase."

THE SAFETY GIRDER RAIL SYSTEM.

An arrangement of live conductor rail for electric traction, which has certain features of interest owing to its adaptability for use in semi-permanent and temporary situations, such as in docks, shipyards, works, &c., and in the carrying out of constructional contracts, has been patented and introduced by Messrs. P. Allman and Co., of 16, John Dalton Street, Manchester, and is known as the Safety Girder Rail System. A good idea of the essential portions of the safety-rail system can be gathered from the sectional views, reproduced herewith, of direct-current and three-phase conductor

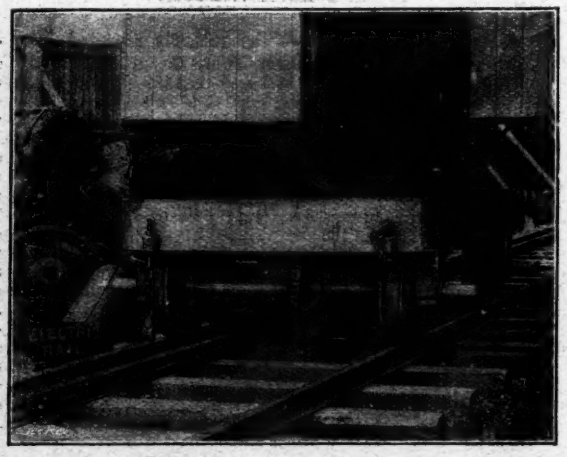


Collector Gear, Safety Girder Rail System.

rails, in which the conductors are attached through insulators to an H-section joist, which is supplied in self-contained sections up to 30 ft. long.

The arrangement, of course, lends itself to variations in detail, and for the temporary work of the contractor, a flat bottomed bull-headed rail, such as is used for temporary railway sidings, can be spiked to the sleepers, replacing the H-section joist.

A more elaborate arrangement provides a bracket on each sleeper, designed to support a continuous protective board on the top and



View showing the Safety Girder Rail used on a Crane Track.

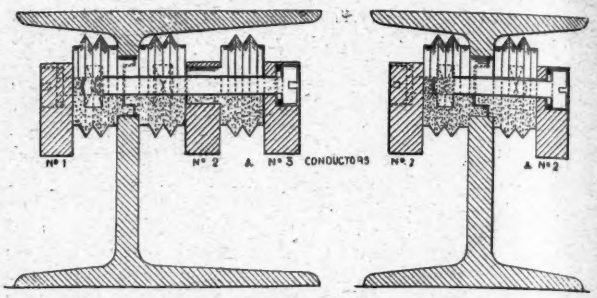
two continuous side timbers, thus almost entirely boxing in the live conductors.

The arrangements so far mentioned are for completely insulated systems, and the makers claim that without protective side timbers they give sufficient security against accidental shocks to workmen, &c. A single conductor, with running rail return, can, however, be used, the conductor being bolted up to the rail through insulators and provided with a protective board.

The cover or top flange prevents sleet from accumulating on the conductors, and thus secures the uninterrupted use of the track—a matter of importance in many cases.

The makers supply a collector gear, link suspended and spring controlled in the case of the over-running type, or with counter-weights for an under-running arrangement, and a special collector gear is provided where points have to be negotiated.

The system, which has been used during the construction of a new dock at Liverpool, for the contractor's cranes, &c., and has replaced



Sections through 3-Phase and Direct Current Girder Rails.

the plug and flexible system for dock cranes at the Blyth Shipbuilding Co.'s yard, is simple in detail, and, we understand, has given satisfaction where it has been used. Our views show a crane running on a track of this description, and the collector gear used in connection with it.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Clyde" Patent Capstan.

In this capstan, manufactured by Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, under Dixon & Baxter's patents, the capstan head is not fixed to the spindle in the ordinary way, but is revolved by a clutch sliding on the upper end of the spindle inside the head.

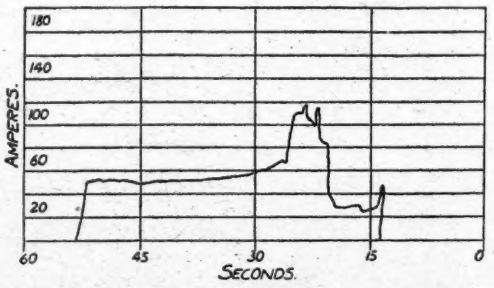


Fig. 1.—Curve of Current Consumption, "Clyde" Capstan.

The rope is, however, permanently attached to the head, giving a positive pull as soon as the head begins to revolve, and thus avoiding the slipping and wearing and lost work which occurs when, as ordinarily, a loose rope is used.

The general arrangement of a handle-type "Clyde" capstan is shown in Fig. 3, and consists of a cast-iron ribbed box, with a watertight manhole, housing a series-wound motor, which

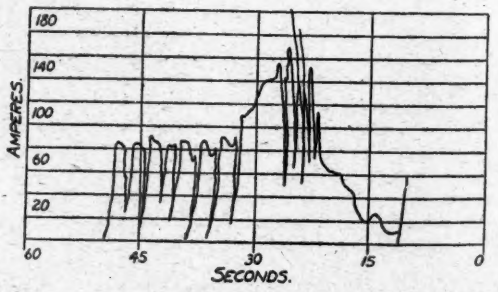


Fig. 2.—Curve of Current Consumption, Ordinary Electric Capstan.

drives through a worm, worm-wheel, pinion and spur-wheel on to a vertical spindle, which is coupled through an internal clutch to the capstan head.

The worm is triple-threaded, of wrought-iron, and gears into a phosphor-bronze wheel, having ball thrust bearings, and running in oil.

Both pinion and spur-wheel are machine-cut steel, and they also run in an oil bath. The motor, controller, main switch and fuses are totally enclosed, and are mounted inside the capstan box, the controller being operated through bevel gear, by a lever which can only be inserted or removed when the controller is in the "off" position.

Lamps are provided for lighting the interior of the capstan box, and for warming purposes.

A number of these capstans are in use at various docks on the Clyde, and various comparative tests which have been made with ordinary electric and hydraulic capstans of the loose-rope type, show that the latter average 3·5 revs. for one of the "Clyde" type in hauling the same distance.

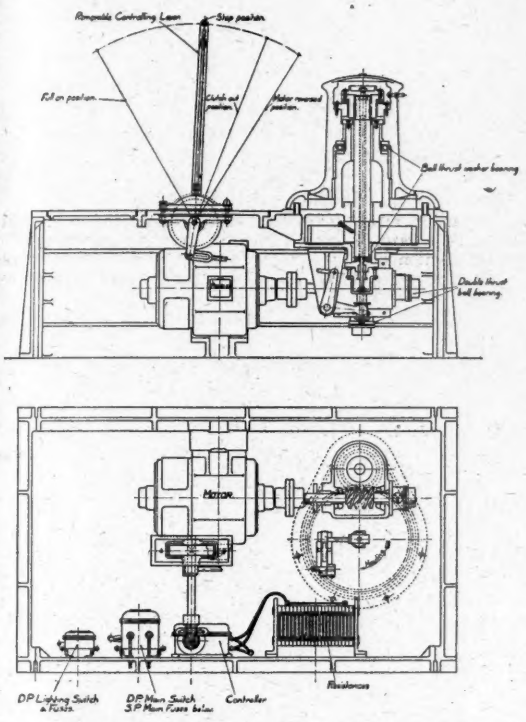


FIG. 3.—HANDLE TYPE "CLYDE" CAPSTAN.

A comparison of this kind shows that when hauling 183 tons over a distance of 80 ft. in 38 sec., the "Clyde" capstan took a maximum current of 116 amps., an average current of 54 amps., or ·138 unit, while an ordinary type electric capstan required a maximum current of 200 amps., and an average current of 69 amps., or ·175 unit, showing an economy in the former case of 28 per cent. in current consumption.

We reproduce two comparative curves of current consumption. An alternative "lever and pedal" type of control is also provided with these capstans, in which the internal clutch is actuated by the pedal, and they can be adapted to work on A.C. circuits.

The "Butt" Arc Lamp.

The most attractive feature of the "Butt" arc lamp is claimed to be its simplicity—"There's nothing in it to get out of order." It possesses no clockwork or shunt coils, and one type of lamp, using ordinary round flame carbons, suffices for direct or alternating-current circuits.

Our views herewith show the exterior of a long-hour type lamp with dioptric inner globe, and the interior of one of these lamps. Dealing with the latter view, the central vertical carbon is clutched; the inclined carbon (to the right), under the influence of a pulling magnet, shown under the cover, is moved laterally in order to strike and form the arc.

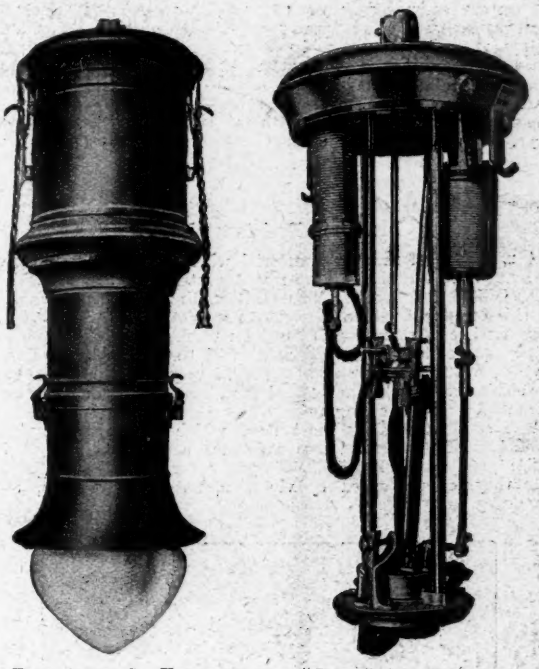
As the carbons do not move horizontally after the arc is struck, the arc chamber is effectively sealed against the rod chamber.

The clutched carbon determines the feed, through slight pressure of its point on a lever, which operates the clutch holding the carbon or allowing it to slide down, according to the consumption of the point. Current is finally interrupted by the automatic discharge of the stump of the clutched carbon.

Conical-shaped inside globes are fitted to all lamps, thus keeping the exterior globes clean, and the latter are closed, air being admitted through openings at the upper brim, passing down between the globes, and rising past the ash tray into the inner globe up to the arc, the fumes of which are carried directly into the open. The dioptric inner globe fitted to long-burning lamps gives a widespread illumination, suitable for street and similar lighting.

The lamp is made in 8, 10 and 12-amp. sizes, in short (8-10) hour, long (16-18) hour and double carbon (32-38-hour) patterns Various diameters of carbon are supplied, according to circumstances, and a change of size only necessitates altering the carbon holders and carbon guide plates—a matter of a few minutes.

In the case of the double-carbon "Butt" lamp, the arc is switched from the first carbon pair to the second, and back again, automatically as soon as the carbons are consumed, and this feature obviates the necessity of using carbons of varying length according to season, thus saving in trimming and carbon costs.



FIGS. 4 AND 5.—VIEWS OF THE "BUTT" ARC LAMP AND INTERIOR MECHANISM.

The "Butt" lamps will also run in series with perfectly satisfactory results.

These lamps (constructed on the Conta patent) are being manufactured by the GENERAL ELECTRIC CO., LTD., of Queen Victoria Street, E.C., at their Witton Works, Birmingham.

"Therma" Heating and Cooking Apparatus.

We illustrate herewith three useful electrical appliances constructed on the "Therma" system, and supplied by the ARMORDUCT MANUFACTURING CO., LTD., of Farringdon Avenue, E.C. These are a two-pint kettle, shown in fig. 7; a domestic iron, fig. 6; and an auto-cistern, fig. 8.

FIG. 6.

FIG. 7.

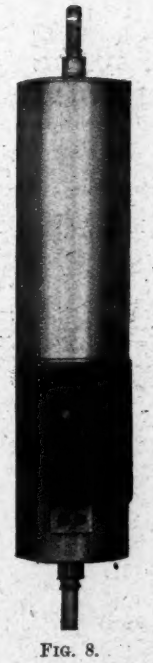


FIG. 8.

"THERMA" HEATING APPLIANCES.

The "Therma" heating elements, with which this apparatus is provided, consist of nickel-steel alloy strip, covered by some non-oxidising metal, and wound on a suitable insulator. For ordinary apparatus mica insulation is preferred, but in the case of the larger

heating apparatus, ovens, &c., a special artificial stone is employed in place of mica.

The construction is such as to facilitate replacements in case of damage to any part. The reliability of the system has been thoroughly tested, several stock pattern irons having been under current continuously for some months, with perfectly satisfactory results.

The "Therma" auto-cistern is constructed on novel lines, being provided with an automatic regulator, which cuts out all the heating elements, except a small one absorbing from 50 to 100 watts, when the water reaches the desired temperature. When the water is drawn off, and the temperature reduced, the circuit is automatically re-established until such time as the temperature has again reached the desired limit.

The "Therma" apparatus covers every description of domestic heating and cooking device, also cigar lighters, bed warmers, soldering irons, glue pots, &c.

Flat-strip Resistance Nets.

A new type of resistance material which Messrs. Schniewindt, of Neuenrade, Westphalia, have recently introduced, and for which Mr. H. H. Cressall, of 13, Summer Row, Birmingham, is sole agent in this country, has been brought to our notice. It consists of a woven grid or net, composed of metal ribbon, with a warp of insulated asbestos thread or string. As will be seen from our illustration, fig. 9, the warp threads are wide spaced, thus providing for efficient ventilation, and exposing an exceptionally large area of the metal strip for cooling.

The strip material is constantan, which has a temperature coefficient of ·000005. These resistance nets are very light in weight, and extremely pliable, being no stiffer than thin cardboard; also they are unaffected by vibration, not easily broken, and

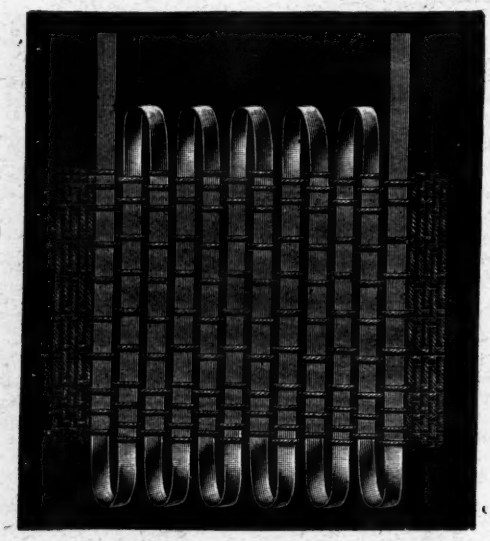


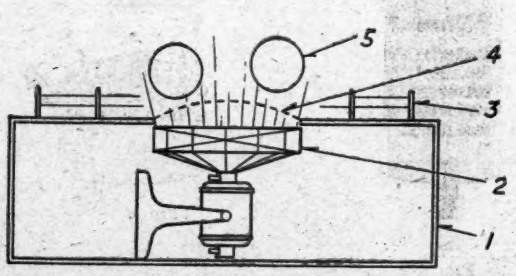
Fig. 9.—Flat-strip Resistance Net.

occupy the minimum of space when built up into complete rheostats, the building-up process being a comparatively easy matter also. They are especially suitable for regulators and controllers, and for motor starters up to 20 h.p.

We may mention that they are stocked in Birmingham by Mr. Cressall.

A Window Prize-Fight.

An effective window novelty, which proved a great attraction in the window of the Baltimore office of the Westinghouse Electric and Manufacturing Co., consisted of a miniature "Jeffries-Johnson" prize-fight, in which the combatants—two light rubber balls, decorated with white and black smiles respectively—were made to bounce backwards and forwards in a diminutive arena. The details of this "electrical" prize-fight can be gathered from the figure reproduced herewith; the fan which supplied the draught was an 8-in. one, of Westinghouse make.



1.—Box, 24 in. square, 6 in. high, 8-in. hole cut in top. 2.—8-in. fan. 3.—Ten posts with two ropes; posts 5 in. from edge of 8-in. hole. 4.—Screen cone 1 in. high, covering 8-in. hole; coarse mesh screen or chicken wire. 5.—Two balls, 3 in. diameter, light rubber inflated; weight about as much as a toy balloon.

Fig. 10.

Tungsten Street-Lighting Fittings.

The importance which street lighting has assumed to the electrical undertaking, and, indeed—to adopt the self-denying attitude of our gas friends—to the ratepayers, since the advent of the highly efficient metal-filament lamp, has led to the introduction

Fig. 11.—"Streetlite" Fitting, with Bracket Arm.

of many handy lanterns suitable for these lamps, singly or in clusters. The Wardle Engineering Co., Ltd., of 196, Deansgate, Manchester, specialise in "Streetlite" fittings of all kinds, and to

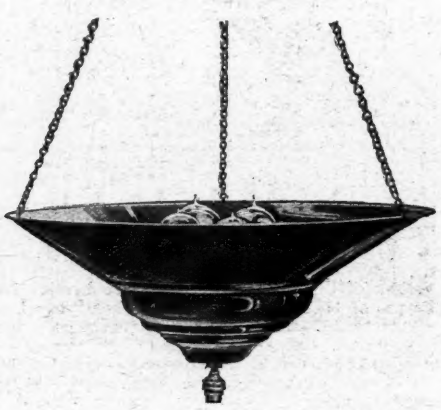


Fig. 12.—"Drawlite" Inverted Fitting.

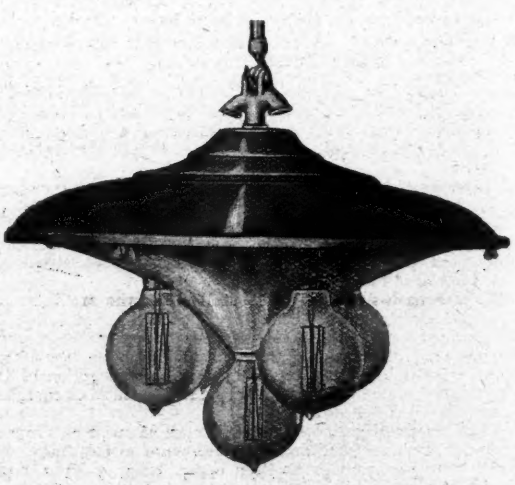


Fig. 13.—Beatark Fitting.

take from a single 50-c.p. lamp to a cluster representing 2,000 c.p., the latter providing an effective substitute for arc lighting under certain conditions. One of these fittings, with a bracket-arm adapted for use on a one-time gas standard, is shown in fig. 11. It

will be seen that the lantern is finished off with a metal bonnet of suitable design; the upper portion of the globe is opal, and ventilation is provided through the bottom of the globe and top of the bonnet.

Another pattern of street-lamp fitting, which meets the tendency to eliminate the globe, is the "Beatark," a view of one of which is shown in fig. 13. In this case a curved aluminium reflector is provided, with apertures for the insertion of the lamps into the holders, and a wide diffusion of light is secured. This fitting, which can be provided with an anti-vibration suspension, is made in three sizes, suitable for either a single lamp or a cluster.

A type of fitting for inverted lighting, in which capacity it is claimed to give a much steadier light than the inverted arc lamp, is the "Drawlite" (fig. 12). This is made of enamelled zinc, 24 in. in diameter, and the lampholder in the base can be used with a plug adaptor if desired.

The Barry and Clarke Temperature Indicator.

This patented apparatus consists of special thermometers placed at points where it is desired to keep the temperature under observation, and electrically connected to a switchboard such as shown in fig. 14.

The thermometers are of the mercury type, but fitted with a special alloy filament running through a glass tube from the bulb to the top of the stem. A predetermined rise in temperature causes the alarm bell on the switchboard to ring and drops an indicator showing the location of the trouble.

The temperature indicating apparatus is independent of the alarm, and the temperature of any point where a thermometer is installed is read direct on the big dial over the board, by inserting a plug in

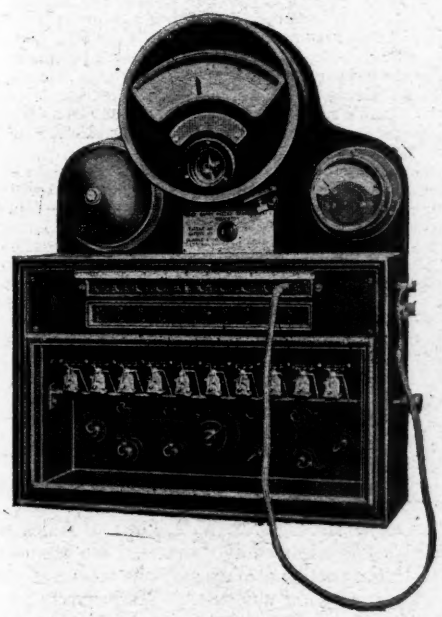


Fig. 14.—Barry and Clarke Temperature Indicator.

the corresponding socket. A recording instrument can be added if desired. The Barry and Clarke indicator has been used at the Union Cold Storage at Canada Dock, Liverpool, for some time, and it is suitable for vessels having refrigerating plants, some of which have been fitted.

It is obviously also applicable in a variety of industries, where accurate temperature conditions are of importance.

This indicator is being placed on the market by Messrs. G. W. Clarke & Co. (Liverpool), Ltd., of 2b, Central Chambers, 17a, South Castle Street, Liverpool who have taken over the Walsall Electrical Co.'s Liverpool branch.

The German Electrical Syndicate.—A few months ago the opinion was expressed in this journal that the so-called secret syndicate in the German electrical industry, which was composed of the four leading manufacturing firms, with the object of attempting to secure all contracts thrown open to public competition, was either no longer in existence, or the revelations of its "price protection" policy had wholly counteracted its efficacy in the matter. It is now announced that the syndicate will expire in October, and is not likely to be renewed. The agreement was at first kept secret, but, on its becoming public, it was severely criticised, and was subsequently only rarely brought into operation, especially as the announcement of the details led to firms, other than those forming the syndicate, being invited to participate in the competitions, and this caused the objects of the syndicate to be frustrated.

THE BRITISH ASSOCIATION MEETING AT SHEFFIELD.

On Wednesday the 1910 meeting of the British Association for the Advancement of Science was opened at Sheffield with the delivery of the inaugural address of the Rev. Prof. T. G. Bonney, Sc.D., LL.D., F.R.S., who assumed the presidency in succession to Prof. Sir J. J. Thomson, F.R.S., who, it will be remembered, presided over the proceedings in Canada last year.

The theme taken by Prof. Bonney for his presidential address is not of electrical interest. He mentioned that he had not selected petrology, as they might naturally have expected, partly because he thought that the great attention which its more minute details had of late received had tended to limit, rather than to broaden, our views, and partly because the discussion of any branch of petrology would involve so many technicalities as to make it tedious to the audience. He therefore selected for discussion some questions relating to the effects of ice, which had engaged his attention a dozen years before he attempted the study of rock slices, and directed his hearers' attention to some aspects of the glacial history of Western Europe.

Before proceeding with this subject, the president alluded briefly to the exceptional progress that had taken place in Sheffield since the Association held its last meeting there, 31 years ago. It had become a city with a Lord Mayor, had enlarged its area by more than one-fifth, and its population had increased from 280,000 to 479,000. "Communication has been facilitated by the construction of nearly 38 miles of electric tramways for home service, and of new railways, including alternative routes to Manchester and London. The supplies of electricity, gas and water have more than kept pace with the wants of the city. The first was just being attempted in 1879, and the second has now 23 times as many consumers as in those days." After alluding to the Sheffield University, he remarked: "I must not now dwell on the great work which awaits this and other new Universities. It is for them to prove that, so far from abstract thought being antagonistic to practical work, or scientific research to the labour of the factory or foundry, the one and the other can harmoniously co-operate in the advance of knowledge and the progress of civilisation."

The Sectional addresses were delivered yesterday morning. That in the Engineering Section, delivered by Prof. W. E. Dalby, M.A., M.Inst.C.E., related to "British Railways: Some Facts and a Few Problems." An abstract of the more interesting part of this address appears below. We also give an abstract of the address of Prof. E. W. Hobson in Section A, together with some editorial comments thereon.

British Railways.

The above formed the subject of Prof. W. E. Dalby's presidential address to the Engineering Section (Section G), which commences with statistical information and curves showing the progress which has been made in the years 1850 to 1910.

He shows that the average working cost per train-mile of the railways in England and Wales, taken over the years 1905 to 1908, amounted to 41·63d., of which locomotive power accounted for 12·07d. and traffic expenses for 12·78d., these being the most important items.

Touching on the locomotive problem, he points out the increasing difficulty in meeting traffic demands, owing to the construction limitation imposed by the gauge.

An accurate estimate of the rate at which work must be done to run a stated service can only be made when numerous data are available, but in a general way, omitting consideration of acceleration, gradients, weather conditions, &c., it may be assumed that the resistance of a train expressed in lb. per ton is given by the formula $r = 5\frac{1}{2} + v^2/256$, and it follows that the H.P. which must be developed at the driving wheels to maintain a speed of v miles per hour on the level with a train weighing w tons, is $\text{H.P.} = w\{v/70 + v^2/96{,}000\}$.

Curves of H.P. are plotted from this equation for various train weights, and the growth of the latter in recent years is indicated from practice. The steadily increasing demand for power directs attention to the problem, What is the maximum power which can be obtained from a locomotive within the limits of the construction gauge obtaining on British railways?

Characteristic energy curves for typical locomotives are given and Prof. Dalby deduces that the indicated H.P. is practically proportionate to the rate at which heat is transferred across the boiler

heating-surface, and as this is again proportional to the extent of the heating-surface, the limit of economical power is reached when the dimensions of the boiler have reached the limits of the construction gauge, the boiler being provided with a fire-grate of such size that, at maximum rate of working, the rate of combustion falls between 70 and 100 lb. of coal per square foot of grate per hour.

Returning now to the consideration of the type of locomotive required for a local service with frequent stops; to start from rest a train weighing, including the engine, 300 tons, and to attain a speed of 30 miles per hour in 30 seconds requires about 1,350 I.H.P. During the period of acceleration the engine must exert an average tractive pull of nearly 15 tons.

An acceleration of 30 miles per hour in 30 seconds is considerably below what may be applied to a passenger without fear of complaint. But it is clear that it is just about as much as a locomotive can do with a train of reasonable weight. Even with a gross load of 300 tons, nearly one-third of it is concentrated in the locomotive, leaving only 200 tons to carry paying load. The problem of quick acceleration cannot therefore be properly solved by means of a steam locomotive; but with electric traction, the limitations imposed on the locomotive by the construction gauge and by the strength of the permanent way are swept away.

The problem of quick acceleration is completely solved by the electric motor.

December 18th, 1890, is memorable in the history of railway enterprise in this country, for on that date the City and South London Electric Railway was opened for traffic.

Since that epoch-marking year, electric traction on the railways of this country has made a gradual, if somewhat slower, extension than anticipated. But electrically operated trains have in one branch of railway working beaten the steam locomotive out of the field and now reign supreme—that is, in cases where a quick frequent service is required over a somewhat short length of road.

At the end of 1908 there were in the United Kingdom 204 miles of equivalent single track worked solely by electricity and 200 miles worked mainly by electricity, corresponding to 138 miles of line open for traffic.

It is not an easy matter to ascertain exactly how much capital is invested in these undertakings for the purpose of electric working alone, since some of the lines originally constructed for a steam locomotive service, have been converted to electric working. On the converted lines there is the dead weight of capital corresponding to the locomotive power provided before electrification took place. The capital invested in the 102 miles of underground railways in London is a little over £25,000,000.

The total number of passengers carried (exclusive of season tickets) on the 138 miles of electrical track during the year 1908 was nearly 342 millions, being, roughly, one-third of the total number of passengers carried on all the railways in England and Wales during the same period.

The average cost of working this traffic is 22·3d. per train-mile. This figure includes the service of the lifts, which is, presumably, returned with the traffic expenses. The charges work out in this way:—

	Per train-mile.
Locomotive power	8·40d.
Repairs and renewals of carriages and wagons ...	1·50d.
Maintenance of permanent way	2·40d.
Traffic expenses	5·22d.
General charges	1·52d.
Rates and taxes	2·36d.
Government duty	0·088d.
Compensation	0·116d.
Legal and miscellaneous	0·75d.
Total	22·35d.

The corresponding total receipts were 38·65d. per train-mile. The working expenses are thus 58 per cent. of the total receipts. Comparing this with the figures for the whole of the lines in England and Wales, it will be seen that the cost for locomotive power on the electric railways appears to be about two-thirds of the cost on steam lines per mile run, the cost for repairs and renewals of carriages and wagons about one-half, and the cost for traffic expenses about one-half.

The two kinds of working are not, however, strictly comparable, as all the conditions of traffic in the two cases are different, and the length of the electric lines is relatively, so small, that the problems which arise out of the transmission of electric power over long distances are excluded. The traffic expenses and the cost of repairs and renewals of carriages and wagons, general charges, &c., are practically independent of the kind of power used for locomotive purposes, and, moreover, the difference in weight of the electric trains and the steam-hauled trains is, on the average, so great that no comparison can be instituted without ton-mile statistics.

Particulars of the systems of electric traction in use are given, with which our readers are already familiar.

During the last ten years a considerable number of trial installations of power-signalling apparatus have been made by the railway companies of this country.

Of the several systems tried and proposed three bulk largest in the equipments applied in this country, namely, the all-electric, the low-pressure pneumatic, and the electro-pneumatic systems.

The "all-electric" system is represented by installations of the McKenzie-Holland and Westinghouse system on the Metropolitan and Great Western Railways, by installations of the "Crewe" system on the London and North-Western Railway, and by installations of Siemens Bros. on the Great Western Railway. The general feature of the all-electric system is that the points are operated by motors sunk in pits by the side of the rails, the signals are pulled off electrically, and all the apparatus is controlled electrically.

The low-pressure pneumatic system is represented by installations on the London and South-Western Railway and the Great Central Railway. The points and signal arms are moved by air, compressed to about 20 lb. per sq. in., and led to cylinders connected to the points and to the signal-arms. The control is also done by means of compressed air, small pipes leading from each air-cylinder to the cabin.

The electro-pneumatic system has found most favour in this country up to the present time. The equipment installed includes such notable stations as the Central at Newcastle with 494 levers, and the Glasgow Central with 374 levers, and the whole of the Metropolitan District system of Underground Railways. In this system an air-cylinder is connected to each set of points and to each signal-arm. Air compressed to 65 lb. per sq. in. is supplied to the cylinders from a main running alongside the railway and kept charged by small air-compressors placed at convenient intervals. Each air-cylinder is provided with a small three-way air-valve operated by an electro-magnet. The movement of each air-valve is controlled electrically from the cabin through the electro-magnet associated with it.

The obvious advantage of power signalling is the large reduction of physical labour required from the signalman. One man at a power frame can do the work of three at the ordinary frame.

Several of the power-signalling installations are automatic in the sense that between signal-cabins on stretches of line where there are no junctions or cross-over roads requiring the movement of points, the movement of the signal-arm protecting a section is determined by the passage of the train itself. The most important equipment of this kind is that installed on the group of railways forming the "Underground" system. This includes the District Railway with all its branches. On this line the particular system installed is the electro-pneumatic, modified to be automatic except at junctions; signal-cabins are placed only at junctions and at places where points require to be operated; a very complete description of the system appeared in the ELECTRICAL REVIEW of March 15th and 22nd, 1907.

The speed at which traffic can be operated by this system of power signalling is remarkable. At Earl's Court junction box 40 trains an hour can be passed each way—that is 80 per hour—handled by the one signalman in the box. As the train approaches the box both its approach to the section and its destination must be notified to the signalman. When it is remembered that with ordinary signalling, to take an express train for example, a signalman hears some 24 beats on the gongs in his box, and sends signals to the front and rear box which give altogether some 24 beats on the gongs in these two boxes, 48 definite signals in all, for every express train he passes into the section which his signals protect, it will be understood that the system must be profoundly modified to admit such a speed of operation as 80 trains per hour per man.

Prof. Hobson's Address.

THE address delivered before Section A on Thursday morning by the chairman, Prof. E. W. Hobson, of which we give an abstract below, was an inspiring one. We are especially interested in the portion dealing with the science of teaching mathematics to physical students. Mathematics nowadays is usually considered in relation to its practical applications—its power to open the doors of the useful sciences; and, with regard to the teaching of it to engineering and physical students, we heartily agree with the remarks of the president when he uttered a caution against the modern craze for mathematical short cuts—a caution that our teachers in the technical institutes would do well to take to heart.

Most of us remember the invention of what is now known as "practical mathematics." At the time we sympathised with the reforming zeal and daring leadership of those who had the courage to tamper with the tradition of centuries in the teaching of this important subject. We understood well enough that a change was made necessary, by the rapid advance of practical science, in the methods of imparting mathematical knowledge to practical students. The old methods were too slow—too laborious. They consumed far too much valuable time—and time costs money in the modern world, and in addition moves along more rapidly. We therefore rather welcomed the change, trusting that in so daring an innovation the utmost discretion would be observed by its promoters and by those who would come after them.

And what is the result to-day? It can be easily stated. The teacher of long experience in technical work, that is to say, the man who knows from actual experience, has discovered that the modern system of practical mathematics, considered generally, is more or less of a failure. It aims at too much and is nowhere efficient, for students in spite of it are always at sea when it comes to the essential, in other words, to calculation. For after all, ability to calculate

rapidly and accurately is all that the engineering teacher asks of the mathematics department. At present he does not get this, and he finds that his students know a little of everything and nothing well.

It is well known that students of engineering form a large proportion of those who attend evening technical schools; in fact, they form the most important class, numerically speaking, in nearly every centre in Great Britain. The engineering student attends for a host of subjects, more or less closely allied, including mechanics, heat engines, geometry, laboratory classes, &c., and the success of the whole of these depends upon a proper system in teaching the mathematics. Yet it is found that the weakest part in the mental equipment of almost every engineering student is that of mathematics, and this does not apply to any one centre or district, but is common over the country. To a painstaking teacher, it is almost heartrending to see his efforts nullified year after year, to see his brightest students at a disadvantage, and to see his duller ones "knocked out" because the mathematics had not been taught to anything like the best advantage. Not that plenty of time is not devoted to the subject in the generality of cases; in fact, the time used up is ample, but what is taught is not what is urgently required, and the important points are not "rubbed home."

It will, perhaps, be scarcely credited that the most crying evil lies in the manipulation of simple equations. It is a fact that nine students out of ten in their second or third years of attendance at the technical school—that is, when they are thinking of leaving it—are quite unable to manipulate a simple equation with any degree of ease. Now, such equations occur in one form or another 10 times for every one of any other kind of mathematical configuration. It can therefore be appreciated that when a class of evening students, say in second or third stage mechanics, assembles, and nearly all the students fail to work out the unknown quantity in an ordinary work equation, a stress equation or what not, it is time to look around for a remedy in the interests of both the teacher and the students. There is only one way to do this, and it has been successfully attempted in a limited number of cases; it is to keep the class working at the manipulation of simple equations for no less a period than three months. This statement may be ridiculed by some and laughed at by others, but, nevertheless, those with long and true experience of the evening engineering student will endorse it. The dictum may be laid down that if a man knows the simple equation from the inside, knows how to manipulate it from every standpoint, and understands it as well as he does his A B C, nearly all his troubles with regard to his future technical training are at an end. At the present time his inability to master it and use it with ease is a curse to both himself and his teacher.

Next to inability to manipulate the simple equation comes the inability to calculate the arithmetical part when the equation has been brought to suitable form. It is certainly deplorable that few students can work logarithms *well*, or the slide rule *well*; most of them, as a matter of fact, can do a little of each, but as they understand neither *perfectly*, they are sure to go wrong if the question is a little involved. Of course, many evening students are lazy, and prefer the teacher to do any laborious calculations, but a good teacher, of course, never permits this; on the contrary, he makes his class calculate everything. He will be lucky if he does not get half a dozen different answers to the same question if more than two or three logarithms have to be looked up. It is a fact that eight students out of ten, even in their third year, are suspicious of logarithms, and can never be relied on to manipulate a negative characteristic. With the slide rule, it is worse. Hardly any student has any proficiency at it. Many carry it with them to class, indeed, and are supposed to be able to work it, but, as in the case of logarithms, the answers it gives to the same question are only remarkable for their variety.

These two points then, inability of simple equation manipulation and uncertainty in arithmetical calculation, are the chains that prevent the evening student from making anything like progress. What cares the engineering teacher whether the members of his class can work at absurd negative indices, solve quadratics by graphs, find equations of curves from plotted points, or even do a little practical calculus, if at the same time he knows not the elements of the simple equation!

Without doubt the exaggerated enthusiasm for modern practical mathematics should be allowed to simmer down and a rational system take its place in a student's first years at the technical school, whereby instead of his learning a heterogeneous mixture of everything, he would be taught a very few things well.

The Scope and Tendencies of Modern Mathematics.

(Abstract of address to the Mathematical and Physical Section, by Prof. E. W. Hobson, Sc.D., F.R.S., *September 1st*, 1910.)

The president commenced with a sympathetic reference to the death of Sir William Huggins. The lifework of that brilliant scientist was rewarded by a rich harvest of results, of which, perhaps, the most important were the discovery of bright lines on the spectra of the nebulæ, and the fact that the Doppler principle could be applied to the determination of the velocities of stars in the line of sight. The "Atlas of Representative Stellar Spectra," published in the names of Sir William and Lady Huggins, remained as a monumental record of their joint labours.

Some of the more elementary conceptions and methods of modern mathematics have become part of the common heritage of our civilisation, interwoven in the every-day life of the people. Perhaps the greatest labour-saving invention that the world has seen is found in our system of numerical calculation. Much effort is required to realise that an idea apparently so obvious embodies a great invention; one to which the Greeks, with their unsurpassed capacity for abstract thinking, never attained. An attempt to do a multiplication sum in Roman numerals is perhaps the readiest road to an appreciation of the advantages of this great discovery.

In a large group of sciences the common language, so to speak, is supplied by mathematics. Each branch of science which is concerned with natural phenomena, when it has reached a certain stage of development, becomes accessible to and has need of mathematical methods and language; this stage has, for example, been reached in our time by parts of the science of chemistry. Even biology and economics have begun to require mathematical methods, at least on their statistical side.

Mathematics shares with the closely allied subject of astronomy the honour of being the oldest of the sciences. A glance at its more recent history will show that it has the energy of perpetual youth. The Royal Society Catalogue contains a list of nearly 39,000 papers on subjects of pure mathematics alone which have appeared in 700 serials during the nineteenth century.

The concepts of the pure mathematician, no less than those of the physicist, had their origin in physical experience analysed and clarified by the reflective activities of the human mind; but the two sets of concepts stand on different planes in regard to the degree of abstraction which is necessary in their formation. Those of the mathematician necessarily lack, in their pure form, just that element of concreteness which is an essential condition of the success of the physicist, but which to the mathematician would often only obscure those aspects of things which it is his province to study. The calculations in mathematics are directed toward ideal precision, those in physics consist of approximations within assigned limits of error. Much of the skill of the true mathematical physicist, and of the mathematical astronomer, consists in the power of adapting methods and results carried out on an exact mathematical basis to obtain approximations sufficient for the purpose of physical measurement.

There exists a widespread impression among physicists, engineers and other men of science that the effect of recent developments of pure mathematics, by making it more abstract than formerly, has been to remove it further from the order of ideas of those who are primarily concerned with the physical world. The prejudice that pure mathematics has its sole *raison d'être* in its function of providing useful tools for application in the physical sciences—a prejudice which did much to retard the due development of pure mathematics in this country during the nineteenth century—is by no means extinct. But a great department of thought must have its own inner life, however transcendent may be the importance of its relations to the outside. Even with a view to applications, if mathematics is to be adequately equipped for the purpose of coping with the intricate problems which will be presented to it in the future by physics, chemistry and other branches of physical science, many of these problems probably of a character which we cannot at present forecast, it is essential that mathematics should be allowed to develop itself freely on its own lines. Who knows what weapons forged by the theories of functions, of differential equations, or of groups, may be required when the time comes for such an empirical law as Mendeléeff's periodic law of the elements to receive its dynamical explanation by means of an analysis of the detailed possibilities of relatively stable types of motion, the general schematic character of which will have been indicated by the physicist?

The belief is very general amongst instructed persons that the truths of mathematics have absolute certainty, or at least that there appertains to them the highest degree of certainty of which the human mind is capable. Any considerations tending to weaken this belief would be disconcerting, and would cause some degree of astonishment. Nevertheless there are two facts which are of considerable importance as regards an estimation of the precise character of mathematical knowledge. In the first place, it is a fact that frequently, and at various times, differences of opinion

have existed among mathematicians, giving rise to controversies as to the validity of whole lines of reasoning, and affecting the results of such reasoning. In the second place, the accepted standard of rigour, that is, the standard of what is deemed necessary to constitute a valid demonstration, has undergone change in the course of time. Much of the reasoning which was formerly regarded as satisfactory and irrefutable is now regarded as insufficient to establish the results which it was employed to demonstrate. For example, since the time of Newton and Leibnitz there has been almost unceasing discussion as to the proper foundations for the so-called infinitesimal calculus. More recently, questions relating to the foundations of geometry and rational mechanics have much occupied the attention of mathematicians. Both in geometry and in analysis our standard of what constitutes a rigorous demonstration has in the course of the nineteenth century undergone an almost revolutionary change. That oldest text-book of science in the world, "Euclid's Elements of Geometry," has been popularly held for centuries to be the very model of deductive logical demonstration. Criticism has, however, largely invalidated this view.

With regard to mathematical invention, a most interesting account has been written by one of the greatest mathematicians of our time, M. Henri Poincaré, of the way in which he was led to some of his most important mathematical discoveries. He describes the process of discovery as consisting of three stages: the first of these consists of a long effort of concentrated attention upon the problem in hand in all its bearings; during the second stage he is not consciously occupied with the subject at all, but at some quite unexpected moment the central idea which enables him to surmount the difficulties, the nature of which he has made clear to himself during the first stage, flashes suddenly into his consciousness; the third stage consists of the work of carrying out in detail and reducing to a connected form, the results to which he is led by the light of his central idea. Thus, after all, a mathematician is a human being, not a logic-engine.

The President remarked that his observations up to the present had reference, in the main, to mathematics as a living and growing science related to and permeating other great departments of knowledge. The small remaining space at his disposal he would devote to a few words about some matters connected with the teaching of the more elementary parts of mathematics. Of late years a new spirit had come over the mathematical teaching in many of our institutions, due in no small measure to the reforming zeal of the general treasurer, Prof. John Perry. The changes that had been made followed a recognition of the fact that the abstract mode of treatment of the subject that had been traditional, was not only wholly unsuitable as a training for physicists and engineers, but was also to a large extent a failure in relation to general education, because it neglected to bring out clearly the bearing of the subject on the concrete side of things. It is a sound educational principle that instruction should begin with the concrete side, and should only gradually introduce the more general and abstract aspects of the subject. At the same time there are some serious dangers connected with the movement towards making the teaching of mathematics more practical than formerly, and in making the recent changes in the modes of teaching, these dangers have not always been successfully avoided. Attempts to fix too rigidly any particular order of treatment of this subject are much to be deprecated and, unfortunately, such attempts are now being made. It is quite true that a great mass of detail which has gradually come to form part—often much too large a part—of the material of the student of mathematics, may with great advantage be ignored by those whose main study is to be engineering science or physics. Yet it cannot be too strongly insisted on that a firm grasp of the principles, as distinct from the mere processes of calculation, is essential if mathematics is to be a tool really useful to the engineer and the physicist. There is a danger which experience has shown to be only too real, that such students may learn to regard mathematics as consisting merely of formulæ and rules which provide the means of performing the numerical computations necessary for solving certain categories of problems which occur in the practical sciences. Apart from the deplorable effect, on the educational side, of degrading mathematics to this level, the practical effect of reducing it to a number of rule-of-thumb processes can only be to make those who learn it in so unintelligent a manner incapable of applying mathematical methods to any practical problem in which the data differ, even slightly, from those in the model problems which they have studied. Only a firm grasp of the principles will give the necessary freedom in handling the methods of mathematics required for the various practical problems in the solution of which they are essential.

Iron and Steel Institute.—The Buxton autumn meeting is to be held on September 26th to 30th, and the following papers are down for reading:—

"Electric Steel Refining," by D. F. Campbell (London).

"The Hanyang Iron and Steel Works," by G. Chamier (Hankow China).

"The Preparation of Magnetic Oxides of Iron from Aqueous Solutions," by S. Hilpert (Charlottenburg).

"The Utilisation of Electric Power in the Iron and Steel Industry," by J. Elink Schuurman (Baden, Switzerland).

"Some Experiments on Fatigue of Metals," by J. H. Smith (Belfast).

STERILISATION OF WATER BY MEANS OF QUARTZ LAMPS.

By MAX VON RECKLINGHAUSEN.

ALTHOUGH the subject of sterilisation by means of ultra-violet rays seems to be quite a modern one, we find, when looking over the literature on the subject, that it has been known for a much longer time than the average reader may suspect.

The earliest time the subject is mentioned seems to be in 1877 by two English scientists (Downes and Blunt), who clearly understood the enormous importance of the action of ultra-violet rays on microbes. Since that time we have had a good many publications showing the important part which the ultra-violet rays of the sun perform in the disinfection of

FIG. 1.—WESTINGHOUSE COOPER-HEWITT STERILISER.

the rivers. It is common knowledge in our days that the bacterial pollution of rivers, such as is caused by large cities, is practically counteracted within a few miles. On the other hand, we know that the pollution of water is not changed if the water does not flow in the open air, *i.e.*, under the influence of the daylight.

The amount of ultra-violet rays which reaches the earth from the sun is very small. It is much more noticeable in high altitudes, where it produces the well-known sunburn; it is only just measurable in low altitudes.

The idea of producing artificial sources of ultra-violet light is not new. The first to demand such a thing was the physicist, and the well-known carbon bisulphide lamp was the first reliable source. The researches of Finsen on the healing action of ultra-violet rays created a new demand for such a source, and he and his collaborators worked out the arc and spark lamps with metal electrodes for this purpose. The next lamp of this kind producing a large quantity of ultra-violet light was the mercury vapour lamp as invented and worked out by Cooper Hewitt; in the lamp sold for the purpose of general illumination, this ultra-violet light is not apparent, because the glass used for the

manufacture of these Cooper Hewitt lamps (ordinary lead glass) is practically a complete absorbent of ultra-violet rays. The first commercial Cooper Hewitt lamps which allowed the ultra-violet rays to pass were the lamps constructed by Schott and Genossen by means of their "Uviol" glass, which had the particular property of being transparent to a large amount of ultra-violet rays. These "Uviol" lamps have found a similar application to the Finsen lamps.

Soon after the "Uviol" lamps, Heraeus started the production of molten quartz, which is considered the glass *par excellence* for ultra-violet light sources, as it scarcely absorbs any ultra-violet rays, allowing practically full passage of all such rays produced by the arc or spark of the metal electrodes which are known to be rich producers of ultra-violet light. The metal mostly used for these lamps is mercury, it being, of all metals, the most suitable and best known in its behaviour for vapour electric lamps. The pioneer work of Cooper Hewitt made it easy to produce such lamps. After some attempts on the part of Schnatter and others, Kuech first succeeded in making a really satisfactory commercial mercury vapour quartz lamp.

It is very strange that, once these great sources of ultra-violet rays were created, the application of these rays for such purposes as indicated at the beginning of the article

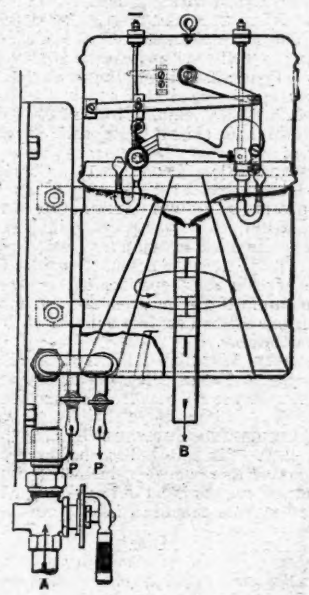


Fig. 2.—Section of Steriliser.

was not thought of for many years, and the literature on these lamps does not show us any application of them for the study of their action on microbes. Furthermore, the patent literature cites only a few cases showing the application of the ultra-violet rays to sterilisation purposes in view of their effect on microbes.

An enormous amount of work on a very large scale has lately been done in France on this subject, and has developed the entire system of sterilisation on different liquids used for alimentary purposes, based on the effect of the ultra-violet rays created in Cooper Hewitt lamps made from transparent quartz.

The chief work in this line has been done by Prof. Henri in the Physiological Laboratory of the Sorbonne University, Paris, together with Dr. André Helbronner, who co-operated with Dr. von Recklinghausen with a view to developing an entire sterilising system of the type described.

The preliminary work was done by studying the action of the ultra-violet rays on different types of microbes, and the influence of the different wave lengths, &c. Dr. Roux, of the Institut Pasteur, in which laboratory a good many of the experiments were made, presented to the Académie des Sciences some of the work done by the above-mentioned gentlemen.

Technically speaking, the results have so far been the development of a small water steriliser for hospital use, where 132 gallons of sterilised water per hour are produced from ordinary city water by means of one Cooper-Hewitt "Silica" lamp, absorbing 3 amperes at 110 volts. A very large sterilising outfit is based on somewhat similar ideas, which sterilises 3,500 cb. ft. of water per hour, thus being large enough to treat the entire water supply of a town of about 10,000 inhabitants.

A view of the apparatus and a diagram showing the internal arrangements is reproduced herewith. No doubt these will prove interesting.

The installation of the lamp is a matter of no difficulty, all that is necessary being to connect up the terminals provided in the dome top of the apparatus and to make the adjustment necessary for the voltage of the particular circuit.

In order that the supply of water delivered from the apparatus may be absolutely sterile or sterile to any required degree, it is necessary that there should be a means of dealing with the various water pressures met with in different districts. To accomplish this, the inlet pipe is fitted with an adjustable valve of a special pattern which can be readily set, so that, when full open, the delivery from the apparatus does not exceed the quantity specified; this, in the case of the requirement being absolutely sterile water, is 132 gallons per hour.

Referring to the diagram, the water enters the chamber formed by the outer cone, with a swirling motion. At the top of this cone it overflows and finds an outlet at the bottom of the inner cone, up which it rises and flows out of the discharge pipe at B. The swirling motion is maintained during the complete passage of the water through the apparatus, in order that it may be thoroughly stirred up and all microbes presented to the action of the light, the water coming under its influence on two distinct occasions.

Drain cocks P are provided on the apparatus, to enable it to be thoroughly drained, should circumstances arise whereby it would not be used for a considerable time.

Not only does this system provide, in the case of the apparatus under discussion, a continuous supply of sterile water available within five minutes, but the water or any other liquid that may be treated, is unaffected as far as taste is concerned, as it retains all natural gases and salts in solution.

The work of Messrs. Henri, Helbronner and Recklinghausen has also been directed towards the complete sterilisation of milk, and this they have also accomplished. The apparatus for this purpose, however, is more difficult to build than that for the treatment of water. Water is very transparent to ultra-violet rays; milk, however, is practically opaque to these rays, and special precautions have to be taken so that it shall be thoroughly attacked.

Lamp-makers' Sports.—Under the auspices of their joint social and athletic club, the Robertson & Osram staffs held their fifth annual sports on Saturday, August 27th. The meeting took place, by permission of the school governors, in the grounds of Latymer Upper School, Wood Lane, Shepherd's Bush, and was carried to a successful conclusion before a large gathering of the staff and their friends. The lamp race for the girls, which is quite a feature of the sports of lamp-makers' operatives, was, as usual, a great success, there being over 60 entrants.

The 5-mile scratch race was won by Mr. T. W. Bailey, who made a splendid effort in the last lap, and won easily from Mr. Bulsworthy, who had led all through.

The relay race between teams of G.E.C. and Osram & Robertson employés was won by the G.E.C. team, who picked up the running in excellent style, winning the Wilson Challenge Cup for the third time. In the tug-of-war, the Sheppard Cup was won by the Robertson team pulling over both the Osram and the G.E.C. teams.

The mile championship for the Fraser Challenge Bowl was won by Mr. L. Hipwell, who ran a fine race throughout, and won with plenty to spare; the 100 yards for the Hirst Challenge Cup was also a fine race, won by Mr. A. Robinson in 11¼ seconds; second and third being Messrs. E. Robinson and A. R. Page.

Mrs. C. Wilson presented the prizes, after which dancing was indulged in to music by the "Clarnico" military band, which also rendered good service during the afternoon.

Our thanks are due to the committee, stewards and stewardesses for a most enjoyable day.

BUSINESS NOTES.

"Osrams" in a Synagogue.—According to the *Jewish World*, an installation of electric light has recently been added to the Bradford Synagogue, consisting of three six-light electroliers, carrying 50-c.p. "Osrams" in the body of the synagogue, and two seven-light "Osram" candle lamps on the Menoreth, on the two sides for the Holy Ark, besides lamps in the organ loft, and the two schoolrooms. They were lit for the first time on Shevuoth and proved a great success. It is believed that this is the first instance of a synagogue in this country being illuminated by metal-filament lamps.

Trade Announcements.—Messrs. Gillespie and Beales, of "Amberley House," Norfolk Street, Strand, W.C., have been appointed sole wholesale agents by the Berry Construction Co., Ltd., makers of the well-known "Tricity" cookers. Local agents are being established by Messrs. Gillespie & Beales in the more important centres of electrical distribution without delay.

The Metallic Seamless Tube Co., Ltd., of Birmingham, announce that Mr. R. Hodgkinson, who has been representing them in the Lancashire district, is no longer connected with the company. They are considerably augmenting the stocks and general capacity of their Lancashire depôts—in Manchester, at 13, Chapel Street, Salford, and in Liverpool, at 19, South John Street.

The Cowper-Coles Galvanising Syndicate, Ltd., of Westminster, announce that, owing to the lease of their works at Chelsea having expired, and to the large increase in their business, they have secured much larger works, known as the Magnet Galvanising Works, Bow Bridge, Stratford, E., where a large up-to-date plant is being installed for their patent regenerative galvanising, which will be worked in conjunction with their improved process of hot galvanising (Cowper-Coles patent). The company will be in a position to undertake the galvanising of all classes of work, including tank work and tubes.

The Smoke Consumption Syndicate, Ltd., who control the Cowper-Coles patents for the consumption of smoke, have recently erected a plant at Willesden for the manufacture of their caloriser bricks. These bricks, which are made of a special material, are used as a lining for the flues at the back of the furnace, so as to obtain an increased temperature, and at the same time consume the smoke. The company is now applying the caloriser bricks to water-tube boilers as well as to Lancashire and Cornish boilers.

Messrs. Balcke & Co., Ltd., have appointed new agents as follows:—For Scotland: Messrs. Morris, Warden & Co., 68, Gordon Street, Glasgow; for Birmingham District: Messrs. Frank R. Cerrito & Co., Exchange Buildings, Stephenson Place, Birmingham.

The British Electric Calibrated Fuse Co. have removed from Harpenden to Luton, Beds., as the old works were too small and there was no room for extensions. Telephone number: "278 Luton." Telegraphic address: "Fuses, Luton."

Dissolutions and Liquidations.—Polesworth Electrical Appliances Co., Ltd.—A meeting of creditors will be held at 36, Cannon Street, Birmingham, on September 6th; Mr. H. Hackett, liquidator.

Bankruptcy Proceedings.—H. J. Burdett, electrical engineer, Rugby and Coventry.—Notice is given of a first and final dividend of 3s. in the £, payable on September 6th at 12, Cherry Street, Birmingham.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. 45, No. 203. London: E. and F. N. Spon, Ltd.—The issue for August contains the following papers:—"Short-circuiting of Armatures and the Resulting Forces on Armature Windings," by Miles Walker; "Turbo Field Magnets for Alternate-Current Generators," by Miles Walker; "Electric Braking on the Glasgow Corporation Tramway System," by A. Gerrard; "Hydro-Electric Installations of Sweden," by A. V. Clayton; "Commutation Phenomena in Direct-Current Machines," by G. W. Worrall; "The Examination of Water by Electrical Methods," by W. P. Digby.

"Practical Measurements." By A. W. Siddons and A. Vassall. 1910. London: Cambridge University Press. Price 1s. 6d.

"Applied Mechanics and Mechanical Engineering." Vol. V. By Prof. Andrew Jamieson. 1910. London: Chas. Griffin & Co., Ltd. Price 7s. 6d.

"British Standard Specification for Portland Cement." Engineering Standards Committee. Revised August, 1910. London: Crosby Lockwood & Son. Price 5s. net.

"Workshop Wrinkles and Recipes." 1910. London: Percival Marshall & Co. Price 1s. net.

"Model Gliders." By E. W. Twining. 1910. London: Percival Marshall & Co. Price 1s. net.

"American Street Railway Investments." No. 17. 1910. New York: McGraw Publishing Co.

"Science Abstracts." Vol. XIII, part 8. Sections A and B. August 25th, 1910. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVI, part 9. August, 1910. London: Andrew Reid & Co., Ltd.

"Year Book of the Michigan College of Mines, 1909-1910," "Graduates of the College, 1909," and "Views of the College." June, 1910. Houghton, Mich.: The College.

"British Engine, Boiler, and Electrical Insurance Co.'s Chief Engineer's Report for 1909." Manchester: 12, King Street.

"Power and its Transmission." By Thomas A. Smith. 1910. London: E. & F. N. Spon. Price 2s. net.

Catalogues and Lists.—Mr. C. Fonteyn, 83, Mortimer Street, Great Portland Street, London, W.—14-page pamphlet, with illustrations, particulars and prices of "Triumph" contact carbon brushes for dynamos and motors.

Messrs. Webster & Bennett, Ltd., Coventry.—32-page catalogue (Section "B") containing a number of good half-tone illustrations and descriptive particulars of their multiple spindle-drilling machines, the smaller sizes shown being adapted for manufacturing purposes and the larger sizes appealing more particularly to rolling stock builders, and gas and marine engine builders. Two sizes of sensitive drilling machines are also shown. Section "B" catalogue (16 pages) contains a description of horizontal boring machines, made by the Werkzeugmaschinenfabrik Union, of Chemnitz, for whom Messrs. Webster & Bennett are sole agents in this country. Copies of these catalogues will be sent on receipt of trade card to anyone interested.

Messrs. E. J. Dugdill & Co., Failsworth.—Leaflet showing a new design of dining-room pendant for electricity or gas.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—76-page catalogue (abridged) No. 170, in which are given full particulars and a large number of illustrations, also prices, of their latest patterns of telephones and electric bells. This publication cancels all previous general issues of the firm's catalogues. Special attention is directed to revised prices of the U 575 wall switchboard for battery or magneto ringing instruments. A separate booklet (No. 168), in which 40 diagrams of connections are given, is supplied to customers on application. The catalogue before us covers Parlyphones, "Twencen" telephones, battery-ringing and magneto-ringing telephones, common-battery automatic intercommunication telephones, waterproof mining telephones, portable military 'phones, extension switches, condensers, junction boxes, waterproof iron-case bells for damp positions, electric sirens, electric bell indicators, bell pushes, fire indicators, batteries, and a variety of wire and wiring sundries.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Several new illustrated price lists have been received: X 1,416, relating to "Witton" switches for 600 volts, single-throw and change-over types; X 1,415, dealing with "Salford" type iron-clad switchgear and house-service and motor cut-outs; E 1,418, describing the "Butt" arc lamp, to which full reference is made on another page of this issue; and E 1,419, particularising several special lines of electric fans.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—August price list of "Aegma" metal lamps.

Messrs. Schmidt's Superheating Co., Ltd., 28, Victoria Street, Westminster, S.W.—32-page pamphlet, containing on alternate pages pictures of locomotives on the great British railways which are fitted with the Schmidt superheater. Facing each picture there appears some specification matter relating to the engine there shown. Notes on economy and maintenance appear on later pages, and a list of engines built in 1910 which are fitted with these superheaters.

Messrs. Lambie, Wrigley & Co., 116, City Road, London, E.C.—Leaflet showing, and mentioning the advantages of, the "Lamrig" spring lock washer for use on all classes of machinery subject to vibration.

Messrs. Engineering Supplies, Ltd., 28, Victoria Street, Westminster, S.W.—Illustrated list showing a number of their original designs of thermometers, including steel, mercury, compensation and self-registering thermometers, also graphite pyrometers and other lines manufactured in the firm's thermometer department.

For Sale.—Messrs. W. Salisbury & Hamer will sell by auction on September 15th the entire contents of No. 2, Electrical Works, Weir Street, Blackburn. Messrs. Fowler, Richardson and Pottier will sell by auction on September 8th a quantity of surplus plant and machinery. See our advertisement pages in this issue.

Openings for Foreign Trade.—France.—An American Consul reports that there is a good opening for gas engines at Calais; also that before many months there will be a good market for electric motors and other electric apparatus, as a new electric plant is about to be built.

Roumania.—An American Consul reports as follows:—"The population of Bucharest is about 300,000. The city is very widespread and covers an area of about 25 square miles. There is at present one street railway system operating about 32 miles of double-tracked lines, of which 3½ miles are electric and 28½ miles are horse-car lines. Upon these, 138 horse cars and 10 electric cars are employed, and the company has six electric cars in reserve. All of the cars are small and of inferior pattern. A few were purchased from Brill & Co., of Philadelphia, some 15 years ago, and the rest were supplied by Dick, Kerr & Co., of London. The concession of the present company expires in six years, and unless an extension is obtained its assets revert to the municipality of Bucharest. A new company, 25 per cent. of whose capital is owned by the city, has lately obtained a charter, and expects in the near future to build and equip 14 miles of electric lines, six of which it is stated will be built in the present year. The old company is attempting to obtain an extension of its concession, but whether it obtain such an extension or its properties revert to the city, a consolidation of the two companies will probably shortly be effected and the electrification of the entire system will then be undertaken."

Spain.—According to American Consul Charles S. Winans, Seville is becoming a manufacturing city for many classes of goods, but the chief drawback to more rapid development is the great expense of motive power, as all the power used is produced by the use of coal or the refuse of olives for generating steam or elec-

tricity. "When the irrigation scheme now under discussion becomes a reality, several reservoirs will be built at different levels, using the water of the Guadalquivir River for the purpose. The falls between the reservoirs will be utilised for the production of electricity for light and power purposes, making it possible for this section of Spain to become a great manufacturing centre. Despite the high cost of motive power, there are now 202 important manufacturing plants in Seville, the most important of which are, doubtless, the three Government factories, which turn out all kinds of war material and employ about 1,700 men. Besides these there are 18 iron foundries and machine shops, five furnaces for the extraction of iron, copper, lead, &c., and two works for the manufacture of screws and bolts. The iron and machine shops manufacture all classes of iron goods. These 18 factories employ about 3,000 men. The iron used is mined in the neighbourhood of Seville. Eleven textile factories for the manufacture of cotton and jute goods are now in operation. A new factory, to be equipped with modern machinery for the manufacture of cotton, linen and jute goods, is now in course of construction, and when completed, Seville will occupy first place in Spain for the manufacture of this class of goods. This factory has a floor space of 27,000 sq. ft., and the machinery is to be driven by a 500-H.P. electric motor. Four important flour and corn mills, all equipped with modern machinery, are located in Seville, while in the towns and villages throughout this section of Spain are smaller ones, mostly poorly equipped, but whose production is considerable. Numerous other industries exist here, as, for instance, a brewery equipped with modern installations and machinery. There is one large electric light plant with three sub-stations, and one plant for electric power for street railways and industrial concerns.

MADRID.—It is stated in a recent trade report that hardware and similar supplies, presumably including electrical devices for light and power, should be much in demand for improvements here. The city has hitherto been without suburbs, but additions, comprising modern houses, are now springing up. The Government is erecting a large building for its Department of Posts and Telegraphs, a large modern hotel (185 rooms) is being built, and a club-house, which has cost £160,000, is nearly completed. Electric elevators are being put in 50 apartment houses, which are now being put up. These few facts are merely an index to progress in which, it seems to us, the British electrical trader might play a part.

TURKISH TRADE.—Merchants and others doing business in Saloniki, Turkey, are shortly to make a commercial pilgrimage to Italy.

An American Consul has written home a very plainly worded report telling Americans why they do not secure more business in Saloniki. "You do not get into direct touch with importers; you are ignorant of the district; you are unwilling to adapt your goods to its needs; you are ignorant of the standing of the more solid business houses, and so you demand unusual terms of payment; you neglect to study the routes of transportation and freight rates, and so you do not quote c.i.f. Saloniki; American exporters are lacking in zeal." This shortly stated, and in our words, is the substance of the chastisement. The report goes on to advise the sending of an "exposition ship" stocked with a large line of goods of all sorts. When Russia did this not long ago, the experiment was a great success!

LIGHTING and POWER NOTES.

Adwick-le-Street.—A scheme of main sewerage and sewage disposal which will involve the use of automatically controlled electrically-driven centrifugal pumps, and is being designed by Messrs. D. Balfour & Son, of Newcastle, is to be carried out.

Argentine.—Some time ago, due to the shortage of water in the San Roque dam, the Cordoba Government built a steam power house in the city, so as to make up the shortage in the output of the hydro-electric station. As the Electric Light Co. has now built a new steam station in the city, the Government station is no longer required, and it will shortly be put up for sale.

Asiatic Turkey.—The ancient city of Tarsus has recently been lighted by electricity under a concession. The power is taken from the Cydnus River. About 1½ miles from the city an 80-H.P. turbine and dynamo furnishes sufficient power for 1,000 lamps; 450 are now used to light the streets of the city, and the remainder will be furnished to private consumers. It is proposed to extend the system to Adana and Mersine.—*Commercial Intelligence.*

Bispham.—The U.D.C. has applied to the B. of T. for consent to use overhead wires for supplying current from the generating station to be erected in Red Bank Road to Richmond Place, Glynn Estate; from the generating station to Norbreck, and from Norbreck Road to Anchorsholme.

The U.D.C. on August 23rd finally adopted the E.L. scheme, the total cost of which, with a refuse destructor plant, is £9,855, for which sum a loan has been applied for. The total is made up as follows:—Electrical equipment, plant, mains, &c., £7,200; site for generating station and formation of streets, &c., £2,105; building for patent dust manipulator, £550.

Blackrock.—At the meeting of the Urban Council last week, a letter from the B. of T. was read asking what action the Council intended to take in regard to its electric lighting order, which would shortly expire. After discussion it was decided to apply for a further extension of time.

Braunton.—Mr. A. Alan Jenkins, A.M.I.E.E., who was consulted by the P.C. as to the E.L. scheme submitted by Messrs. Crompton, has reported favourably, both as to the scheme and the price to be charged for public lighting—2·15d. per unit. The P.C. will meet next week to definitely decide as to the adoption of the scheme.

Bury St. Edmund's.—A L.G.B. inquiry was held on August 24th into the application of the T.C. for a loan of £1,463 for additional plant at the electricity works, viz., a 200-KW. engine, switchgear, pipework, &c. There was no opposition.

Chelmsford.—The B. of G. has been recommended to adopt power for driving machinery at the workhouse laundry, at an estimated cost of £560.

Consett.—On the occasion of a fire at the Stoney Heap Pit of the Consett Iron Co., Ltd., last week, the oil engine driving the pump was disabled, and there was danger of the workings being flooded. With commendable enterprise, the Cleveland and Durham County Electric Power Co. ran a cable to the pit head and installed a step-down transformer with a 60-H.P. motor and pump. This effectively prevented any flooding of the pit.

Continental Notes.—SPAIN.—According to *Commercial Intelligence*, a British company has purchased from the Spanish holders a concession for the construction of dams across the River Ebro at certain points, and is about to build a dam on the Ebro at a point some 20 miles from a place known as Mora del Ebro, at a cost of about £200,000. The water thus impounded will, it is calculated, give from 30,000 to 50,000 H.P., and enable the company to supply all the towns and villages for some 150 miles around with electric power.

Dundee.—In the endeavour to settle the differences which are well known to exist amongst them, the electrical contractors and the Corporation electrical engineer have had a meeting. It is stated that an arrangement has been come to by which it is hoped that friction will be considerably lessened, if not entirely prevented, in the future.

Greystones.—At the adjourned meeting of the Rathdown (No. 2) R.D.C. last week, a communication was received from the L.G.B. in reply to the Council's proposal to obtain a loan for the purpose of providing public lamps in Greystones for lighting by electricity. The L.G.B. stated that it was not aware that it had any authority to empower the Council to borrow, if it did not intend to apply to the B. of T. for a provisional order, or licence authorising it to supply electricity. The solicitor to the Council also wrote similarly. Mr. Hewson said that in Ballinrobe and elsewhere in the West of Ireland the urban councils did their lighting without any provisional order. It was the policy of the L.G.B. to play into the hands of the B. of T. and put expense on the taxpayers, and they should carry out the lighting without bothering with the B. of T. The further discussion of the matter was adjourned pending inquiries.

Halifax.—The Electricity Committee has considered a recommendation of a sub-committee to spend £10,000 on new plant at the electricity works. It was stated that the suggested expenditure was necessary owing to the greatly increased demand for current for power purposes, and the fact that at present the works are taxed to their fullest capacity.

Haslingden.—At the Town Council meeting on August 25th, it was reported that the B. of T. had sanctioned the arrangement whereby Accrington Corporation should supply electricity to Haslingden; it also agreed to defer revoking the Haslingden Electric Lighting Order for one year from September 30th. The Mayor expressed pleasure that this matter, which had occupied so much time, was now settled. If in 12 months' time they got a reasonable number of consumers, the undertaking would be likely to prove successful.

Iceland.—The question of gas *v.* electricity has been exercising the Reykjavik T.C., half the members of which are women. The women voted unanimously for a gas installation, on account of its facility for cooking; the men went solid for an electrical plant. The Mayor gave his casting vote with the women, and arrangements are now being made for the erection of a gasworks.

India.—According to the *Times* correspondent at Bombay, a company is being formed there to put down plant to utilise certain available water power at Lanauli, in the Western Ghats, in the generation of electrical energy and for the transmission of the same for power purposes to the mills and factories in the Bombay district. The scheme is to equip a plant of 30,000 H.P., the capital of the proposed company being £1,133,220.

Japan.—According to the last Japanese mail the Government has granted a charter to the Kinugawa Hydro-Electric Co. to supply electric power to the Tokio Railway. The period of the charter is 25 years, and all wires must be carried underground, except where special permission is obtained from the municipal authorities of Tokio.

Llandudno.—The U.D.C. has decided to install two additional mechanical stokers at the electricity works, at a cost of £260.

The Council has decided not to support the Bill of the I.M.E.A. seeking powers for local authorities to supply fittings, &c., and to undertake wiring work.

Manchester.—Mr. Percival, secretary of the Manchester Ratepayers' Association, replying to a statement of a representative of the Manchester Retail Traders, that the latter Association had satisfied itself that the Local Government Board's decision regarding the recent electricity loan was just, says no answer has been received from the L.G.B. in reply to his (Mr. Percival's) letter asking upon what authority the Board relied for dispensing with a public inquiry, though the Ratepayers' Association had been informed by the Electricity Committee that the Board acted as it did by virtue of the Electric Lighting Act, 1909. According to the accounts furnished to the Ratepayers' Association by the Electricity Committee, tentative sanctions for recent loans to the amount of £34,000 were granted in 1907, and this money had now been spent. In round figures, the sum of £30,000 had been spent in providing equipment for 23 consumers who, with one exception, were large manufacturers, and they were, according to the admission of the Electricity Committee, supplied with current at cost price. The total capital outlay of the Electricity Committee was £2,680,800, and the sole return from that to the general body of ratepayers this year is £15,000, or less than ¾ per cent., obtained under great pressure. In any case, the operations of the Electricity Committee "ought to be dealt with in full daylight when applications for large sums are made, for it is only at a public inquiry that the policy of the Committee can be searchingly, and therefore adequately, examined. The action of the L.G.B. is a new departure, and in a wrong direction, and it should be resisted in every legitimate manner possible."

Ramsbottom.—Five years ago the H.T. mains of the Lancs. Electric Power Co. were carried through Ramsbottom to their extremity at Edenfield; a transforming chamber has now been erected in Paradise Street, and fitted with the necessary transforming machinery, receiving H.T. current at 10,000 volts. The L.T. network is carried to the works of the Shuttleworth Weaving Co., which are now to be driven by electricity instead of steam, while they are also to be electrically lighted. Quite a number of business firms in the town have placed orders for the electrification of their premises, and the supply of electricity which is now available for domestic and industrial purposes is sure to have a marked impetus in the direction of the development and expansion of the district

South Hylton.—Owing to the growth of the demand for electric light and power in this district, the County of Durham Electric Power Distribution Co. is making important extensions to its sub-station in the South Hylton village which will bring its capacity up to 2,800 H.P. New transformers, by Brown, Boveri and Co., supplied by Messrs. Richardsons, Westgarth & Co., are being installed, which will be operated by means of high and low-lension switchgear supplied by the Electrical Company and by Messrs. Reyrolle & Co., of Hebburn-on-Tyne. The sub-station is fed from the 20,000-volt trunk main from the company's power station at Carville

Seaton Delaval.—There having been a considerable growth in the use of electric power at Blyth and the local collieries, a large sub-station with a capacity of over 4,000 H.P. has recently been installed by the Newcastle-on-Tyne Electric Supply Co. for supplying, among other purposes, the Co-operative Stores. Its dimensions are 47 × 22 × 26 ft. high. and it will contain five transformer chambers. The transformers and the high-tension switchgear are supplied by the Electric Co., of London, the low-tension switchgear by Reyrolle & Co., of Hebburn-on-Tyne. The power will be supplied to the sub-station from the central power station of the company at Carville through its 20,000-volt northern trunk main.

Tasmania.—The Longford Municipal Council has just started an electrical installation for street and private lighting. An 80-H.P. Crossley suction gas plant and 45-KW. generator, together with a battery, booster, &c., have been provided, and some 30 street lamps and 550 private lamps are being installed.

Todmorden.—A L.G.B. inquiry was held on Friday last relative to the application of the Corporation to borrow £300 for lighting the Town Hall by electricity.

West Ham.—The T.C. has received from the L.G.B. sanction to loans of £118,525 for electricity purposes.

TRAMWAY and RAILWAY NOTES.

Argentina.—According to the *Review of the River Plate*, the Sante Fe municipality called for tenders for the electrification of its tramways about a year ago, but rejected the proposals which were made. Fresh tenders have now been received which it is stated are not so advantageous as the previous ones.

Australia.—The strike of the Perth (W.A.) Tramway Co.'s employés still continues, but it is considered that it will not last much longer, as the company has managed to start a small day service.

Chile.—During the year 1909 the Government gave much attention to the question of electrifying its line between Valparaiso and Santiago, a distance of 114 miles. The route is to be double-tracked throughout before proceeding with electrification proposals, one of which has been submitted by an Italian concern, which proposes to take its pay out of the savings made by electrical working.

Continental Notes.—AUSTRIA.—Good progress is being made with the conversion of the tramways in the town of Agram, Croatia, to electric traction, about 4 miles of the reconstructed lines having just been opened for traffic.

BELGIUM.—La Société des Tramways Bruxellois has secured a concession for a new line of electric tramway from the Avenue de la Reine, at Laeken, to Jette-Saint-Pierre.

Hastings.—A case of a somewhat unusual kind was the recent arbitration under the Workmen's Compensation Act, arising from the claim of a driver against the Hastings and District Electric Tramways Co. The motor man, William Remane, alleged that his eyesight had suffered from flashes at the studs under approaching cars while driving on the Front line, which it will be remembered is equipped on the Dolter surface contact system. He gave evidence tending to show that his vision was normal during the years he had driven overhead trolley cars, but had become defective—causing him to loose his employment as a driver—since working cars over the Front section. The defective nature of the Dolter system was admitted by the tramway company, but not that the appliances were defective. Medical and other evidence was called on behalf of the plaintiff, one witness expressing a preference for viewing a 1,000-C.P. arc rather than the severer flashes on the line. Eventually the judge decided to hold over his decision in view of the importance of the case.

Keighley.—The question of applying for powers to construct additional tramways was mentioned at the last meeting of the T.C. After some discussion, it was decided that permission be given to the Tramways Committee to inspect a system of trackless trolley vehicles.

London.—The widening of Bishopsgate Street Without has been commenced, and when completed will provide a 70-ft. thoroughfare, which will enable the L.C.C. tramways to be extended from Shoreditch High Street into the precincts of the City.

Milnrow.—The U.D.C. has received a prov. order for the extension of the tramways from Firgrove to Newhey, and the construction of the lines will be proceeded with forthwith by the Rochdale T.C.

Newcastle-on-Tyne.—At a meeting of the Tramways Committee on August 24th, the town clerk reported that the Newcastle Guardians Assessment Committee had agreed to reduce the assessment on the city tramways to the figure suggested by the Tramways Committee. The appeal, which had been entered for hearing at the coming Newcastle Quarter Sessions, will therefore be withdrawn. Our correspondent adds: The settlement arrived at with the Assessment Committee is an important one, and, calculated on the present rates, will effect a saving of nearly £2,000 annually to the tramways undertaking. In 1907, after arbitration proceedings in which Sir Francis Blake acted as arbitrator, the assessment was put at £32,000, being based on a year of high profits and low expenses. Subsequently the figure was brought down to £30,000, but when a further reduction was asked for on a worse balance-sheet, a readjustment was refused. An appeal was entered at Quarter Sessions, but when the award of Sir Francis Blake was re-examined by the Assessment Committee, it was found that the tramways were paying on a value greater by £4,000 than that on which they ought to have paid. Consequently the assessment was reduced to £26,000.

The sub-Committee of the Corporation Tramways Committee has made a tour of the surrounding district with a view to arranging extensions of the present system, the extensions being mainly proposed to be on the trackless system outside the city boundaries, but within the city the present system of tramways is proposed to be continued. One of the extensions is proposed by way of Shieldfield, on to Jesmond Road, and Heaton Cemetery, making a circular route by Chillingham Road to the existing lines in Shields Road. It is also suggested that trackless services be arranged between Scotswood and Newburn, and Scotswood and Blaydon. At present there are no trackless cars on Tyneside, although the Gateshead and District Electric Tramways Co. recently endeavoured to obtain powers for their use.

Portsmouth.—The assessment of the tramways having been raised from £31,747 gross and £15,534 rateable to £40,510 gross and £23,510 rateable, the Corporation has unsuccessfully appealed against the same. It has been decided to retain the services of a firm of rating experts to investigate the Assessment Committee's figures.

Swansea.—On appeal the assessment of the Tramway Co.'s undertaking has been reduced from £7,970 to £7,495. The latter figure is an increase of £1,600 on the old assessment.

Torquay.—The B. of T. has appointed Mr. Archibald Reed as arbitrator to act in the dispute which has arisen between the T.C. and the Tramway Co. as to the use of the stud system. The company contends that it is not possible to effect an improvement in the working of the stud system, while experts engaged by the T.C. advise that the system can be perfected.

U.S.A.—A further attempt is to be made to improve the ventilation of the New York subway by the installation of fans on 50 cars; all the cars will be similarly equipped by next summer at a cost of over $100,000. Four fans are to be fixed in the roof of each car.

Wigan.—Acting on the recommendation of Mr. C. W. Mallins, manager of the Liverpool Tramways, a brief *résumé* of whose suggestions was reported in our issue of August 19th, the Tramways Committee has decided to construct a new loop and extend certain present loops between Union Bridge, Newtown, and the Market Place, to construct a new loop in Station Road, opposite the Great Central Railway Station, and a new loop in Scholes, between Union Street and Wellington Street. This will facilitate the services on the routes concerned, and, at the same time, will provide a more satisfactory running of the cars on the Ashton, Pemberton and Orrell routes. The Committee also decided to purchase six new double-deck single-truck covered-up cars, for service on the Standish route.

TELEGRAPH and TELEPHONE NOTES.

Anglo-Continental Telephones.—A deputation of English postal engineers and officials has been conferring with the German authorities with a view to obtaining an improvement of the German landlines, so as to facilitate speech between London and Berlin over the new French cable.

The French Director of Telegraphs says that probably the French Government will decide to lay a new cable between Cape Grisnez and Dover, in which case a reduction of the rates may be considered.

Italian Telephones.—The Bill for extending the Italian telephone system relates to 21 sections, the four longest being Genoa-Milan, 108 miles; Venice-Udine, 79 miles; Rome-Naples, 161 miles; and Catania-Messina, 63 miles.—*B. of T. Journal.*

"Marconi Press Agency."—It is stated that the Marconi Co. intends to organise an agency for the purpose of receiving news from the principal liners at sea in all parts of the world.

New Atlantic Cable.—The Mackay Companies are understood to have arranged to lay another cable on the Ireland-Newfoundland-New York route at a cost of some three million dollars.

Wireless Telegraphy.—According to the *Standard's* American information, a wireless message was last week successfully transmitted from a moving aeroplane at a height of 500 ft., a mile distant from the receiving station.

Wireless Telegraphy at Cape Town.—It would appear that there is a likelihood of wireless telegraph stations being established at Cape Town and on the Cape Coast. Many of the liners which regularly call there are now fitted with wireless, and so far Durban is the nearest land station. The Union Castle Co. are only awaiting the erection of a wireless station at Cape Town before giving orders for the installation of wireless apparatus on all their principal boats. Two new steamers for the P. and O. branch service *viâ* the Cape, which are being built by Messrs. Laid & Co. will also be fitted with wireless. The numerous telephone and telegraph wires stretching in all directions across the docks are now being cabled, and several unsightly and dangerously situated telegraph standards will be removed.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 12th. Electrical goods, for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman offices, near Aberdare.

Atherton (Lancs.).—Tenders are to be invited for materials required in connection with a new main in Bag Lane and low-tension cables along Wigan Road. Mr. C. T. Astbury, electrical engineer, Town Hall.

Australia.—September 7th. Battery material and glassware for the P.M.G.'s Department in Queensland. See "Official Notices" July 22nd.

September 20th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 5th.

September 27th.—Electric lamps for the P.M.G.'s Department in Victoria. See "Official Notices" August 12th.

October 4th.—Telegraph and telephone insulators for the P.M.G.'s Department in the States. See "Official Notices" August 12th.

October 4th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria See "Official Notices" August 19th.

October 4th.—Telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 19th.

October 5th.—5,000 porcelain insulators, for the P.M.G.'s Department in New South Wales. See "Official Notices" August 19th.

October 17th.—Telegraph and telephone material, for the Deputy Postmaster-General, Hobart. Commonwealth High Commissioner's Office, 72, Victoria Street, London.

Victoria.—Telephone cable and insulators, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

Melbourne.—H.M. Trade Commissioner for Australia (Mr. C. Hamilton Wickes) reports that tenders will be received at the office of the Deputy Postmaster-General, Melbourne, as follows:—September 6th, for the supply of 100,000 porcelain insulators (Schedule No. 375); October 18th, for 23 miles of telephone cable (Schedule No. 284), and 500 composition insulators (Schedule No. 374); October 25th, for 10,000 Cordeau insulators (Schedule No. 373).

The *Australian Mining Standard* of July 27th states that tenders will be received at the office of the Deputy Postmaster-General, Melbourne, up to September 20th, for the supply of telegraph and telephone material (Schedule No. 308). Local representation is necessary in each case. Copies of the specifications and forms of tender in regard to each of the foregoing contracts may be had from the High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W., where also preliminary deposits may be paid. Copies of the specifications may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 72, Basinghall Street, London, E.C.—*B. of T. Journal.*

Tasmania.—October 17th. Telegraph and telephone instruments and material, for the P.M.G. See "Official Notices" to-day.

Belgium.—September 14th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), are inviting tenders for the supply of the electrical rail connections required by the company during the year ending September 30th, 1911.

Brighton.—Tenders are to be invited by the T.C. for the supply of pipes, valves, &c., to carry out the new condenser circulating system in connection with the electricity works.

Calcutta.—September 19th. Motor-generators, turbo-alternators and condensing plant for the Cossipore station and sub-stations of the Calcutta Electric Supply Corporation, Ltd. See "Official Notices" August 26th.

Canada.—The *Canadian Engineer* states that under the heading Fort William, Ont., that the Joint Street Railway Board favours the purchase of an electric locomotive, to cost about $15,000.

Carlisle.—September 5th. Coal storage and conveying plant for the City Electricity Department. See "Official Notices" August 19th.

Chile.—September 30th. Three multiple dynamos and searchlights, also machines and tools, for the Chilian Navy. Deposit, 5 per cent. of estimate. Particulars from and tenders to the Junta Económica, Dirección del Material, Valparaiso. See *Board of Trade Journal.*

Durban.—The T.C. has adopted a recommendation of the E.L. and Power Committee that tenders be invited both in South Africa and in England for the supply of switchboard, jet condensing plant, converters and H.T. cable.

Egypt.—October 20th. Electrical installation and refrigerating plant, for asylum at Khanka. Specification from Chief of Administrative Service, Public Works Department, Cairo; for particulars as to tendering see *Board of Trade Journal.*

France.—November 1st. The Prefect of the Department of the Yonne, at Auxerre, is inviting offers for the construction of a system of metre-gauge electric or steam railways in the Department, the aggregate length of the proposed lines being about 233 kilometres.

Lancaster.—Six 25-H.P. shunt-wound motors, with starting switches, for Messrs. Waring & Gillow, Ltd. See "Official Notices" August 12th.

Littleborough.—September 13th. Alternating-current (single and three-phase) meters, for the U.D.C. Hawtayne & Zeden, 9, Queen Street Place, London, E.C.; or G. H. Wild, Clerk to the Council (returnable deposit of £2 2s. to the clerk).

London.—Hackney.—September 15th. Extension of the main switchboard, for the Borough Electricity Department. See "Official Notices" August 12th.

Mountain Ash.—September 12th. Electrical stores for 12 months, for the U.D.C. See "Official Notices" August 26th.

Mozambique.—October 12th. The authorities of the Harbour and Railway at Lourenco-Marques, Mozambique, are inviting tenders for the supply of seven electrically-operated cranes, ranging in capacity from 1 to 10 tons.

New Zealand.—December 15th. Installations of wireless telegraphy at Doubtless Bay, Gisborne, Cape Farewell, Sumner and Bluff. See "Official Notices" August 5th.

Pontypridd.—September 5th. Low-tension rubber-insulated cables, with lead or fireproof covering, for the Corporation Electricity Department. See "Official Notices" August 26th.

Rochdale.—The T.C. has decided to invite tenders for the construction of tramway extensions from Shawforth to the Bacup borough boundary.

South Africa.—September 28th. According to the *South African Mining Journal* of August 6th, tenders are invited by the Durban Corporation for the supply of an elevated jet condenser and piping, switchboard, rotary converters, cables and transformers. Tenders may be sent to the Corporation, Durban, or the London agents to the Corporation, Messrs. Webster, Steel & Co., 5, East India Avenue, Leadenhall Street, E.C.—*B. of T. Journal.*

Uruguay.—September 30th. The municipal authorities of Tacuarembó are inviting tenders for the equipment of an electric generating station and the supply of electric light at San Fructuoso. Tenders will be received at the Secretaría de la Intendencia Municipal de Tacuarembó, Tacuarembó.—*B. of T. Journal.*

Walthamstow.—September 9th. Supply and erection of battery. Particulars from Engineer, Electricity Works; tenders to C. S. Watson, Clerk, Town Hall, by 12 noon on above date. See "Official Notices" to-day.

Warrington.—September 13. Electrical requisites for six months, for the B. of G. Arthur Bottomley, Clerk, Bewsey Chambers, Warrington.

CLOSED.

Battersea.—The B.C. has placed an order with Messrs. Pooley & Austin for a new feeder switchboard.

Bolton.—The Electricity Committee has accepted the following tenders:—

Newton, Chambers & Co.—Feed-water tank for the electricity works.
James Bradbury & Co.—Brickwork.
J. B. Scholes & Sons.—25,000 tons of coal.

Brighton.—The T.C. has been recommended to accept the tender of Messrs. Richardsons, Westgarth & Co. for pipes, valves, &c., to connect up the condenser of the new turbine set with the harbour, at £870. The work is necessary, owing to the existing pipes conveying sea water being partly choked with mussels, &c.

Dewsbury.—The Education Committee has accepted the tender of Mr. J. T. Foggo for the electric light installation at the new schools at Batley Carr, at £100.

Dundee.—The Corporation has accepted the offer of Mr. T. C. Keay to fit up 500 stair electric lights. The amount of the offer is £323.

Durban.—Our Durban correspondent reports that at the last meeting of the Electric Light and Power Committee of the Town Council, the borough electrical engineer presented a comprehensive report on the general question of new power plant required, as the large demand makes it necessary to take immediate steps to increase the plant. In accordance with the advice contained in this report, the Committee recommended acceptance of Messrs. C. A. Parsons & Co.'s tender for the supply of two turbo-alternators, each of 2,000 KW., for the sum of £12,920. The Council approved.

Fleetwood.—The Congregational Church is to be lighted with electricity. Mr. R. Barron, of Albert Street, has received the contract.

Holland.—The Bergmann Electricitätswerke Gesellschaft, of Berlin, has submitted the lowest tender to the municipal authorities of Amsterdam for the supply and erection of a steam turbine and alternator at the municipal electric lighting station.

Norway.—The city authorities of Bergen are reported to have entered into a contract with the Norsk Elektrisk and Brown, Boveri & Co., of Christiania, for the supply of an electric power transmission installation, to be erected near the Samnanger Falls. The plant is to be provisionally of 10,500 H.P., but is to be capable of extension to 28,000 H.P.; the transmission line is to be 21·7 miles long, and the pressure 50,000 volts. The same company has also concluded a contract with the town electricity works of Hamar for the delivery of electrical machinery; whilst an order has likewise been booked for a power plant of 6,000 H.P. for transmission of energy from Skollenborg to Sande for the operation of sawmills.

Walthamstow.—The U.D.C. has accepted the following tenders in regard to six double-deck tramcars:—

Hurst, Nelson & Co., Ltd.—Car bodies (with spring fenders), £1,860; trucks, £426.

Brush Electrical Engineering Co., Ltd.—Electrical equipments, £1,684.

The tender of Bartlett & Sons, at £112, for a weighbridge at the electricity works, has also been accepted.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Tuesday, September 6th. At 3.30 p.m. Visit to the Naval, Mercantile Marine and General Engineering and Machinery Exhibition at Olympia.

Municipal Tramways Association.—September 21st to 23rd. Annual conference at Bradford.

NOTES.

The Gutter Press!—Our warmest congratulations to Mr. *Punch* for this week's cartoon, with our fervent hopes that it may have the much to be desired result.

Brussels Exhibition Fire.—The following letter has come to hand too late for inclusion in our "Correspondence" columns:—"With regard to the erroneous statements published in certain quarters that the recent fire was due to electrical causes, and in view of the possible prejudicial influence this might have on electrical interests, your readers will be interested to know that I have the assurance of the engineer and director of the electrical department of the City of Brussels that the fire was not caused electrically.

"Further, I am assured that the electrical supply in the buildings where the trouble started had been cut off some hours prior to the fire commencing.

"My Committee trust you will find space in your next issue for this letter.—H. B. Renwick, *Chairman of the Electric Supply Publicity Committee.*"

Ozonisation of Water in Russia.—It is reported that an important order, representing £600,000, is in prospect for the Russian Siemens & Halske Co., of St. Petersburg. It relates to a scheme which is on the point of being submitted to the Ministerial Council and which aims at the introduction of a substantial improvement in the water supply of St. Petersburg. It is proposed, in particular, to construct a special waterworks for the sterilisation of the water by means of ozone. The Siemens & Halske Co. built a similar plant a year ago, and the approaching presentation of the new scheme is said apparently to show that good results have been obtained from the ozonisation of water. It is, therefore, considered to be very probable that the order in question will be placed with the Russian Siemens & Halske Co.

Arc Works Athletic Club.—A very successful and highly interesting athletic meeting was held on Saturday last, August 27th, on the Wood Street ground of the Arc Works Athletic Club. The meeting was favoured with fine, if somewhat dull, weather, and was on novel lines, being open only to employés of Chelmsford engineering firms. The number of entries totalled 234, exclusive of the relay and tug-of-war teams, and 125 competitors took part in the events, representing the following firms, Messrs. Christy's, Hoffmann's, Marconi's, Clarkson's and Crompton's (Arc Works). Great rivalry naturally prevailed amongst the competitors, each man striving not only to win a prize, but also to help his side gain the most wins, and a large and enthusiastic crowd of spectators was, in consequence, treated to some splendid sport. The track was five laps to the mile, and the mile relay race was for teams of five; four teams entered, and E. H. Barns (Arc Works) finished some 60 yards in front of Clarkson's representative, the race thus going to Arc Works.

The best race of the day was the mile bicycle handicap, W. W. Spalding (Marconi's) losing to Blackburn (Clarkson's) by inches only, in the last few yards, after leading him all the way. W. W. Spalding, by the way, was the most successful competitor, winning the half-mile bicycle race and the high jump, and being placed second, as already stated, in the mile bicycle race.

Messrs. Marconi's representatives secured the most wins, gaining 5 firsts, 6 seconds and 5 thirds, being followed by Hoffmann's with 4 firsts, 3 seconds and 1 third; Clarkson's secured 3 firsts, 1 second and 1 third, the Arc Works gaining 2 firsts, 2 seconds and 3 thirds, while the nearest Christy's team could get to a win was second in the tug-of-war, which was won by Hoffmann's.

After the racing an excellent open-air cinematograph entertainment and firework display was given; dancing also took place, an excellent band being in attendance, and the ground was illuminated by eight arc lamps, power for which was obtained on the spot from the battery of an electric 'bus.

Electrical Production of Steel.—It is announced from Stockholm that the Swedish Electro-Metal Co. has formed a new company by the registration of the Electro-Metal Co. in London. The object is the exploitation of the inventions of the engineers, Messrs. Lindblad, Grönväll & Stalhane, concerning the production of iron and steel by means of electricity in England, the British Colonies and North America. The capital of the new company is 550,000 crowns, and two Swedish engineers are at the head of the undertaking. It is added that the Swedish Electro-Metal Co. has commissioned the Iron Industry Bank to erect electrical works equipped with the electro-metal furnace near Trollhättan, and the bank has sanctioned the expenditure of 250,000 crowns for this purpose, and made an arrangement with the owners of the Trollhättan Waterfalls for the supply of 3,000 H.P. The Swedish iron and steel producers are also interesting themselves in this type of electric furnace. It is probable that a large ironworks to be equipped on this system will soon be established in North America, whilst a furnace of this type is already in course of construction in Sheffield. The Swedish company, which established a Norwegian Electro-Metal Co. at Christiania a year ago, still possesses

the patent rights for the inventions in other countries. Mr. Eyde, who has withdrawn from the management of the Norwegian Power Co. for the utilisation of the waterfalls in Telemarken, has been elected on the board of directors, but will otherwise devote himself to the interests of the Norwegian Electrochemical Co., in which he and some Norwegian capitalists have secured the majority of the shares. It is now the intention of Mr. Eyde to take up the manufacture of iron and steel by means of electric smelting, according to the patents of Mr. Grönvall, which were recently acquired for this purpose. The scheme aims at the erection, it is said, of works at all places on the coast where the conditions are favourable.

Complimentary Dinner to Mr. Rider.—On Thursday evening of last week some of Mr. John H. Rider's friends invited him to a quite informal "send-off" dinner at Pagani's well-known restaurant in Great Portland Street, with Mr. S. Z. de Ferranti, the President-Elect of the Institution of Electrical Engineers, in the chair. He was supported by the following gentlemen, who also played the part of hosts: Messrs. P. A. Lange, A. H. Preece, W. W. Cook, James Gray, A. N. Connett, Sidney Sharp, M. Railing, E. Parry, A. T. Turney, J. C. Peache, G. W. Partridge, J. Shepherd, A. H. Walton, E. J. Fox, H. Kingsbury, O. H. Baldwin, H. Scholey, E. G. Izod, H. Alabaster, T. E. Gatehouse, H. W. Kolle, and A. P. Zani. Letters and telegrams regretting their unavoidable absence were received from Messrs. G. Sutton (host), W. R. Cooper (host), C. P. Sparks, Sir W. H. Preece, F. Gill (host), F. R. Davenport, Robert Hammond (host), J. E. Kingsbury, C. H. Wordingham (host), Hugo Hirst (host), A. L. C. Fell, S. Beeton, T. O. Callender, J. S. Highfield and W. Rutherford (host). Speeches were confined to the toast of "Our Guest," given in a brief but touching manner by the chairman; the reply of Mr. Rider, who spoke very feelingly, being evidently moved by the spontaneous and hearty response given by those present to the toast of his health and success in his new sphere of operations, and to "The Chairman," proposed by Mr. Sidney Sharp in a somewhat lengthy, but highly diverting, post-prandial oration, in which he gave many reminiscences of his personal adventures in South Africa—so far as could be gathered, some 50 years ago—where he was the first to plant the British flag in some spot, the name of which we have forgotten. His references to his love for his brother-Boer, and his unabashed statement that he had slept for 18 months on the Veldt, with only the sky as a coverlet, were received with unfeigned surprise, accompanied by cries of "Shame!" During his wanderings, however, Mr. Sharp has, at all events, discovered the secret of perpetual youth!

A menu card, signed by everybody present in their best after-dinner caligraphy, will no doubt be treasured by our friend, who sails to-morrow for South Africa, as amongst the dearest of his earthly possessions, for it will serve as a memento of an eventful evening which, we know from Mr. Rider himself, will not readily fade from his memory. The dinner was worthy of Pagani's famous establishment; the greatest good feeling was evinced by the company for their honoured guest, and he must have felt that, by his unassuming demeanour and high sense of duty as the chief electrical engineer to the L.C.C. during the 10 years he has held that appointment, he had endeared himself to a large number of his colleagues, who will wish him God-speed in his new sphere.

Mine Fatality Claim.—A judgment of much interest to mine owners and managers has been issued by Sheriff MacLeod, at Linlithgow. The case was an adjourned one, and arose out of a fatal accident to a pump attendant in Pit No. 3, Blackrigg Colliery, Torpichen, occupied by the United Collieries, Ltd., the cause of death being alleged to have arisen through the deceased coming into contact with a faulty joint of a live electric cable. The proceedings were against John Leckie, mine manager, Blackriggs, he being charged with having failed to see that a competent person was on duty and in charge of the electrical apparatus installed at the colliery when the same was in use, contrary to the Coal Mines Regulation Act, and of the eleventh additional rule for the installation and use of electricity established at the said colliery, to the effect that a competent person shall be on duty at the mine when the electrical apparatus is in use. The Home Office desired a decision as to what was a competent person within the meaning of the special rules governing the working of electrical plant in mines. His Lordship said that the question was whether what Mr. Leckie did was sufficient. As he did not know what Mr. Leckie did, he could not say whether it was sufficient or not, and therefore found the charge not proven. It seemed to him that His Majesty's Inspector of Mines ought always to find out on going to a mine what the manager had done, and he had taken the liberty of suggesting to the Home Office a very simple expedient whereby the Inspector should always be able to find out what he had done. Mr. Leckie's real time of anxiety now began, because he would not know for some time whether this was a good or a bad judgment. The Home Office may take the case to the High Court for a decision.

Appointment Vacant.—York.—Meter clerk for the Corporation. See "Official Notices" to-day.

Educational.—The City of Bradford Education Committee has just issued its prospectus of the arrangements for tuition in the evening schools, which is of interest to those connected with the electrical trades by reason of the fact that at the Branch Commercial and Technical Schools an electrical course is again being held for electrical engineers, telegraphists, wiremen, electric light workers, car drivers, &c.

Goldsmiths' College, London.—Courses of instruction in all branches of engineering will commence on September 26th. Syllabuses of the Engineering Department from the WardeGol smiths' College, New Cross, S.E.

The I.M.E.A. Bill for Further Powers.—We have received from the hon. sec. of the Association, Mr. H. Faraday Proctor, a list showing that in the promotion of a Bill to give municipal electricity suppliers further powers, some 36 authorities have agreed to give financial support, 16 will give moral support, five favour the proposal, while a dozen will take no action. The matter is, of course, still under consideration in many cases.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—Steps are being taken to convene a meeting in Glasgow on September 17th, with a view to the formation of a branch, or branches, of the Association in Scotland. Particulars can be obtained from the General Secretary, Bank Chambers, London Road, Derby.

Institute of Metals.—The autumn meeting will be held in Glasgow, on September 21st-23rd. There will be a reception by the Lord Provost and the Corporation, visits to works of metallurgical interest, and an all-day trip to Arran and the Kyles of Bute, as well as a programme of six papers. Particulars can be obtained from the Secretary, Caxton House, S.W.

Fatality.—While working in the South Rhondda colliery, a miner, named John Jones, was killed. At the inquest on Wednesday at Glamorgan, it was stated that while some girders were being put up on the main road, Jones picked up a few yards of loose wire and fell down, dying from an electric shock. A Home Office expert suggested that whenever repairs were in progress the electric cables should be protected and disused wire removed. The jury endorsed this opinion, and found that death was caused by electric shock.

Electricity in Agriculture.—On Tuesday, August 30th, at the Royal Horticultural Society's Show held at Vincent Square, London, Mr. J. T. Priestley gave the results of some interesting experiments in electrifying crops, that is, running wires discharging electricity over fields and through glass houses. These experiments have been carried out in order to gain some idea of the increase in yield which could be expected from electrified crops over the yield from crops not electrified. The experiments were carried out at Evesham, and the results show that electrified mangold has given 18 per cent., strawberries 25 per cent., and wheat 29 per cent. greater yield than the non-electrified crops; again, with regard to cucumbers, five separate glass houses had been taken, the first three of which had current run through them, while the other two were not electrified, and the April picking resulted as follows: Electrified houses, 487, 485 and 434 cucumbers respectively; non-electrified houses, 214 and 343 cucumbers. Mr. Priestley also stated that not only at Evesham was electricity being experimented with on these lines, but also at Bitton (Bristol) and in Scotland and also in six different places in Germany. The idea was also being considered as a means of increasing the cotton crops in Egypt.

Encyclopædia Britannica.—We have received from the Syndics of the Cambridge University Press the information that they have taken over from the *Times* the copyright and control of the "Encyclopædia Britannica," a new edition of which is now in the press. The work will form "a completely new and original survey of human knowledge, down to the summer of 1910," and for the first time has been constructed as a whole, and will be published as a whole. The last (tenth) edition appeared in 1902, but the bulk of it was merely a re-issue, with 11 volumes added to bring it up to date. We understand that the preparation of the eleventh edition was begun by the *Times* in May, 1903, but the enterprise was found too onerous to be carried through as an adjunct to the ordinary functions of a great newspaper, and was handed over to the Cambridge University Press, in whose care it may be depended upon to maintain and increase its reputation as the foremost work of reference used by English-speaking people throughout the world. It will be issued in 28 volumes by the University of Cambridge about the end of this year, and will comprise 26,000 pages, in which the work of some 1,500 distinguished contributors will be embodied. The ordinary edition will weigh 2,000 lb., but a special issue will be made on India paper, with flexible binding, which will weigh only 60 lb., and occupy only 2 ft. instead of 6 ft. of shelf room.

Brussels Exhibition.—Great credit is due to the patriotism and enterprise of the numerous firms which have agreed to participate in the new British Section at Brussels Exhibition; from a list given in the *Times*, of August 30th, we note that they include in the scientific and engineering sections the following exhibitors:—The Cambridge Scientific Instrument Co., Messrs. Gambrell Bros., Messrs. Kelvin & James White, the Morgan Crucible Co., Messrs. Nalder Bros. & Thompson, Mr. R. W. Paul, Messrs. Mavor & Coulson, and in the decorations and furniture section, Messrs. Doulton & Co., Electrelle, Ltd., Messrs. Faraday & Sons, the Vacuum Cleaner Co., and Messrs. R. Waygood & Co.

St. Petersburg Exhibition.—Referring to the international exhibition demonstrating the application of electricity to railways, to be held at St. Petersburg from April 15th-28th to July 15th-28th, 1911, the *Board of Trade Journal* states that the British Acting Consul at that place has now forwarded copies of the programme, form of application for space, &c., which may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade

Private Meeting.—John Sutcliffe & Co., electricians, George Street, Oldham.—The creditors of the above were called together a few days ago, when a statement of affairs was presented showing liabilities amounting to £263 14s. 10d., all of which were due to unsecured creditors. The assets were estimated to realise £180 6s. 6d., less £1 6s. 8d. for the claims of preferred creditors, leaving net assets of £178 19s. 10d., or a deficiency of £84 14s. 10d. The assets were as follows:—Book debts, £133 19s. 9d.; stock-in-trade estimated to produce £30; cash at bank, £6 6s. 9d.; and household furniture, £10. It was reported that the debtor, who was seriously ill, was 80 years old. For some time past the business had been managed by his son. The latter attended the meeting, and informed the creditors that his father was unable to make any offer. After a short discussion the creditors unanimously resolved that the estate should be dealt with under a deed of assignment, with Mr. H. L. Price, I.A., Manchester, as trustee. A committee of inspection was also elected, consisting of the representatives of the General Electric Co., Messrs. Ward & Goldstone, and Veritys, Ltd.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Upon leaving the service of the Manchester Corporation to take up the position of station superintendent with the Sunderland Corporation, MR. WILFRED YORKE has been presented with a German silver planimeter by the staff at the Stuart Street Station, also with a Faber calculating rule from some of the men.

A smoking concert was held on Saturday, August 6th, in connection with the Electric Light Department of the Durban Corporation, when MR. JOHN ROBERTS, borough electrical engineer, was presented with a leather writing case and Goerz prismatic binoculars as a token of esteem from the staff, previous to his departure for a six months' holiday in England. There were 53 members present, the chair being taken by Mr. J. T. Smith, the power station superintendent, while the presentation was made by Mr. E. Poole, assistant borough electrical engineer, who will have charge during Mr. Roberts's absence in England.

The Secondary Schools Sub-Committee of Burnley T.C. has recommended that the borough electrical engineer be paid an honorarium of £60 for preparing and supervising the electric light installation at the Technical Institute.

MR. F. LENG, of the Sheffield Corporation Electric Supply Department, was, on the 25th inst., presented with a marble clock, on the occasion of his departure to take up the position of canvasser under the Marylebone Electricity Department. In the absence of Mr. Fedden, general manager, the presentation was made, on behalf of the staff and employés, by Mr. Cridge.

On Tuesday, the Taunton T.C. appointed an electrical engineer in succession to MR. E. B. THORNHILL. Although the salary offered for the appointment was only £200 a year, there were 82 applicants. The post was given to MR. A. J. HOWARD, formerly chief assistant engineer at Taunton Electricity Works.

General.—The staff of the electrical engineers' department at Chatham Dockyard has presented a travelling bag, a case of pipes, and a safety razor to MR. W. J. RHODES, who has been appointed inspector of electrical fitters at the Cape of Good Hope Dockyard.

MR. W. MALLINS (general manager of the Liverpool Corporation Tramways) has been chosen by the Tramways Committee to attend the Sixteenth International Congress at Brussels, together with the chairman and vice-chairman; and Mr. Mallins and Mr. Alfred Clough (resident electrical engineer) with the chairman and vice-chairman, will be the delegates at the annual conference at Bradford from September 21st to 23rd.

MR. FRANK CASSELS has not gone to take up his residence in New Zealand as quoted from a Buenos Ayres contemporary last week. He has merely gone there on a short visit.

MR. H. B. PRENTICE, late branch manager in the Yorkshire district for the Metallic Seamless Tube Co., has joined Messrs. Siemens Bros. Dynamo Works, Ltd., as traveller in the Newcastle, Hull and Middlesbro' district.

Tramway Officials.—MR. THOMAS TATE, traffic superintendent of the Wakefield Tramways, who has taken a contract with Leeds T.C. and the Wakefield and District Light Railway Co., has been presented by the tramway staff with a purse of gold.

Obituary.—MR. R. H. HAYNES, M.Inst.C.E., borough engineer of Newport, Mon., passed away on August 20th, at the early age of 48 years. Our readers will remember that the deceased gentleman acted with M. Arnodin as joint engineer in connection with the construction of the Newport electric transporter bridge over the river Usk a few years ago.

NEW COMPANIES REGISTERED.

Chilian Northern Railway Co., Ltd. (111,449).—This company was registered on August 25th, with a capital of £500,000 in £1 shares, to undertake a concession granted by the Government of Chile for the construction and operation of a line of railway from Pueblo to Lagunas, to carry on the business of constructors of railways, tramways, electric light and power works, and other public works and conveniences, and to adopt certain agreements, the parties to which are not named. The subscribers (with one share each) are:—G. Dickson, 20, Lovelace Gardens, Southend, shorthand writer; L. H. Butcher, 52, Gaskarth Road, Balham Hill, S.W., clerk; A. G. Webber, 37, Thornton Street, Brixton Road, S.W., clerk; F. J. Seal, Bridgham, Bournemouth Road, Merton Park, S.W., clerk; W. E. Rogers, 31, Links Road, Mitcham Road, S.W., clerk; T. H. Penwarden, 10, Cleveland Park Crescent, Walthamstow, clerk; H. Hurley, 25, Sidney Road, Stockwell, S.W., clerk. Private company. The number of directors is not to be less than two or more than six; the subscribers are to appoint the first.

T. & J. Jackson, Ltd. (111,461).—This company was registered on August 25th, with a capital of £11,000 in £1 shares (5,000 preference, 5,000 ordinary and 1,000 deferred), to take over the business of electricians, electrical and mechanical engineers, machinists, fitters, founders, dynamo and motor manufacturers, &c., carried on at 14, Park Road, and 15, Hill Street, Marylebone, by T. Jackson and J. Jackson, as "T. & J. Jackson and Co." The subscribers (with one share each) are:—T. Jackson, 14, Park Road, Regent's Park, N.W., electrical engineer; J. Jackson, Wenlock, Hindes Road, Harrow, electrical engineer. Private company. The first managing directors are T. Jackson and J. Jackson. Registered office, 14, Park Road, Regent's Park, N.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Northwich Electric Supply Co., Ltd. (46,958).—Particulars of £11,000 debentures, created December 5th, 1904 (having the benefit of a trust deed dated January 12th, 1905, already registered), filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's freehold and leasehold hereditaments and general assets. Trustees: Brunner, Mond & Co., Ltd.

J. C. Lyell & Co., Ltd.—Mortgage debenture dated August 1st, 1910, to secure £500, charged on the company's undertaking, present and future. Holder: Mrs. H. Lyell, 30, Christchurch Road, Streatham Hill, S.W.

Johnson & Phillips, Ltd. (84,968).—Issue on July 28th of £13,000 debentures, part of a series of which particulars have already been filed.

Electrical Apparatus Co., Ltd.—A memorandum of satisfaction in full on August 19th, 1910, of debentures dated October 27th, 1909, securing £500 has been filed.

CITY NOTES.

French Westinghouse Co.

THE report of the Société Anonyme Westinghouse, of Paris, to which brief reference was made a week ago, states that the degree of employment at Freinville was normal during 1909, and the results for individual departments at Havre were also satisfactory, but the construction of automobiles was entirely abandoned on account of being unremunerative. Including £3,400 brought forward, the gross profits amounted to £51,000, of which £12,000 was from investments, the total comparing with £71,000 in 1908. After meeting management expenses, the cost of increasing the share capital, interest charges and depreciation, there remains a balance of only £440, as contrasted with £14,000 in 1908, when a dividend at the rate of 5 per cent. was distributed. The report states that the Italian Westinghouse Co., in which the company had held the greater portion of the capital of £160,000, paid a dividend of 4 per cent. for 1908. In the meantime the French company had disposed of a number of the shares, although still retaining control over the undertaking. The Italian market had now been almost wholly left to the Italian company. After referring to the Hungarian Automobile (Westinghouse) Co., favourable mention is made of the Société pour l'Exploitation des Procédés Westinghouse-Leblanc, which distributed 40 per cent. for 1909, whilst the English Heintz Co. paid 12 per cent. for 1909, as against 16 per cent. in the preceding year, and the Centra à l'Ocean Tramway had, for the first time, concluded the year with a profit. The share capital of the French Westinghouse Co. was raised from £600,000 to £800,000 during the year, and the bonds remained unchanged at £300,000, but mortgage debt of £160,000 was redeemed.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for dividends on the company's 7 per cent. cumulative first preference and 6 per cent. cumulative second preference shares, for the half-year ended June 30th, 1910, have been posted.

Yorkshire Electric Power Co.

The directors report that the growth of the company's business is proceeding steadily and satisfactorily. The company's customers have increased their demands, and a number of important new customers have been connected during the half-year ended June, 1910. The receipts from the sale of energy and for work charged out to consumers, &c., amount to £16,675, against £11,169 and £8,698 respectively in the corresponding halves of 1909 and 1908. The gross profit on the revenue account for the half-year is £4,950, against a gross profit for the half-year ending June 30th, 1909, of £2,599, and a gross profit for the half-year ending June 30th, 1908, of £1,250. After payment of mortgage interest (£799 more than the corresponding half of last year) the net revenue account shows a profit on the half-year just ended of £2,622, compared with a profit for the corresponding half-year in 1909 of £1,070, and a profit for the half-year ending June 30th, 1908, of £363. Further remunerative business is being pressed upon the company in districts not yet covered by the company's mains, but in order to meet this further capital is required. On February 15th last, at an extraordinary meeting of the company, a Bill giving power to issue a portion of the unissued shares of the company as preference shares, and for other purposes, was submitted to the shareholders. This Bill, with slight alterations, received the Royal Assent on July 26th, 1910. In June, a draft prospectus proposing an issue of £100,000 of 6 per cent. cumulative preference shares was sent to each shareholder, and on July 5th a conference of the shareholders was held, when the proposals of the directors were unanimously agreed to. It is now necessary to hold an extraordinary meeting of shareholders to pass a resolution sanctioning the terms of issue. If this is approved it is intended to offer the issue to shareholders, second mortgagees, and customers of the company, and to shareholders and customers of Electrical Distribution of Yorkshire, Ltd.

The Question of German Amalgamations.

Various reports of prospective fusions of electrical firms have been in circulation on the Berlin Stock Exchange. From a well-informed quarter the *Berliner Tageblatt* learns, however, that there is no question, either now or later on, of an amalgamation of the Siemens-Schuckert Works, or of the Schuckert Electricity Co., with the Siemens & Halske Co., as no reasonable ground could be found for such a fusion, whilst, on the other hand, very considerable interests are opposed to it. A closer connection of the Schuckert Co., of Nuremberg, with the Siemens & Halske Co., or with the Siemens-Schuckert Works, of Berlin, is unnecessary, for the reason that the Schuckert Co., which, since the transfer of its manufacturing business to the Siemens-Schuckert Works, has remained purely a participation or trust company, undertook the contractual obligation on the formation of the latter company to allocate to the Siemens-Schuckert Works, at contractually fixed prices, all the orders to be placed or received by the company. A transformation of the Siemens-Schuckert Works, Ltd., into a share company, eventually by amalgamation with the Siemens & Halske Co., is also out of the question within a conceivable period. It would only have any signification if it were proposed to dispose of partly or wholly, or to place on the market the parts of the Siemens-Schuckert Works if converted into shares. But such a measure would not come into consideration for the Siemens and Halske Co., which, as is known, possesses the simple majority of the parts in the Siemens-Schuckert Works. As far as concerns the Schuckert Co., the latter is unable to dispose of the parts in its holding without first having asked the Siemens & Halske Co. to exercise the preferential rights contractually devolving upon it in regard to the acquisition of the parts. As a sale of the parts, or of the shares, to be provided in the Siemens-Schuckert Works consequently does not come into consideration, the motive put forward that a very considerable "quiet reserve" would be rendered free for the Siemens & Halske Co. and the Schuckert Co. out of the conversion of the Siemens-Schuckert Works into a share company, becomes untenable. The shares would possess for both companies the same internal value as the parts. It is added that an amalgamation of the Siemens & Halske Co. with the Siemens-Schuckert Works would finally serve no technical working object, as both companies are now already administered in common. Moreover, a considerable expansion in the share capital of the Siemens & Halske Co. would be necessary, but this would be opposed by the endeavour of the Siemens family to keep the majority of the shares in its own possession.

Mersey Railway Co.

The half-yearly meeting was held on Friday, at Worcester House, Walbrook, E.C., Mr. James Falconer, M.P., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 308), said he was glad to be able to chronicle another half-year of substantial progress. The receipts had increased by £1,425, and the expenditure had decreased by £1,274, showing a net increase in revenue of £2,699. If they took the working for the whole year ending June 30th, it would be seen that the receipts had amounted to £109,016, as compared with £105,421 for the previous 12 months—an increase of £3,595—whilst the working expenses had amounted to £66,986 against £72,169, a decrease of £5,183, so that there had been a net gain during the year of £8,778. He thought the shareholders would agree with the board in regarding that as a very satisfactory result. If they compared the present position with the position in the last half-year of steam working, the result was very striking. In the last half-year of steam working the number of passengers carried was 3,357,000. During the half-year now under review the number had increased to 7,395,000, an increase of over four millions, or 120 per cent. During the same period the receipts had increased from £29,470 to £54,653 last half-year, an increase of 85 per cent. The reason for the increase was the obvious one which had been made apparent from half-year to half-year ever since they adopted electrical traction, viz., that largely owing to the facilities which the railway gave for connecting Liverpool with the Wirral peninsula, the districts which it served had steadily developed and continued to develop. There was no saying what the future development would probably be, seeing that the railway served one of the finest residential situations to be found anywhere in the United Kingdom. He did not think anyone could place a limit to the possibilities of the place, if they continued to afford the public facilities to get to and from Liverpool. As far as the Mersey Railway was concerned, he believed it was giving the best train service which was to be found anywhere in this country, and he had had people over from America who had told him that they had no railway equal to it there. Their policy would continue to be to give to the districts they served the very best service which could possibly be given. The accounts showed that they commenced the half-year with a debit revenue balance of £16,191. They had been able to reduce that, as the result of the past half-year's working, to £11,821, a reduction of £4,370. That debit balance stood in the way of payment of interest upon the debenture stocks, but by the Act of Parliament which they obtained last session, they would be able on January 1st next to place that debit balance to capital. Therefore from the commencement of next year any profits they might make would be immediately available for paying the holders of the first of the debenture stocks the interest which was due upon them. The holders of those stocks had had to wait a very long time and they had supported the shareholders very consistently, and it was therefore a great satisfaction to the directors to be able to say that there was every reason to believe that on January 1st next they would begin to be in a position to earn enough to commence to pay upon the first of those debenture stocks. That really was the first fruits of the policy which began in 1903 by the equipment of the line with electrical traction, and it would be a great gratification to the board when they were able to begin the distribution of dividends.

Mr. Robert Cooper seconded the motion.

Mr. Pringle, as a large holder of preference stock, and also to a small extent as a deferred stockholder, congratulated the board upon the present position of the company and its future outlook. He said it was quite refreshing to hear the chairman's speech, and to note from the figures given in the report that for the last 15 half-years the railway had shown a continuously improved position. At the present rate of progress the board next July would be able to make the first payment on the 1866 debenture stock, and they would, no doubt, go on paying the interest regularly from that date. After that came the 1871 stock, then the 1882 stock, and then the "B" stock, and after that he hoped it would not be long before the preference shareholders would have a look in for their dividend. He believed that some of the large railway companies had an eye upon their company, but the longer the question of purchase was deferred, the better price they would get for the undertaking, so he hoped the directors would not do anything in that direction yet.

Mr. G. Williams suggested that it would be greatly to the advantage of both companies if the Wirral Railway could be electrified.

The Chairman, in reply, said that regarding the sale to any other company he was entirely of the opinion of Mr. Pringle, that with a concern improving as theirs was it would be a very misguided policy if they were to go running about seeking for somebody to purchase it. As to the electrification of the Wirral Railway, it was obvious that for the development of the district served by that company, it would be a great advantage if the railway was worked electrically, for electric traction was really very much better adapted for suburban traffic than any steam railway, however excellently managed, could possibly be. He, however, was not in the secrets of the board of the Wirral Co., nor did he know their reasons for adhering to steam traffic. The matter was one entirely for themselves. Their relations with the Wirral Co. were of the most friendly character, but they had never attempted to interfere with one another's business in any way. Undoubtedly the characteristic of the district was enterprise, and he could not help thinking that sooner or later the natural instinct of the Liverpool and Birkenhead people to do the best for their districts and their undertaking would bring about the change to electrification. While they would welcome the change, there was nothing which they could with propriety do in the matter.

The report was adopted.

United Electric Car Co., Ltd.—The directors recommend a dividend of 2½ per cent. for the year ended June last.

Dumbarton Burgh and County Tramways Co.—The directors have declared a dividend at the rate of 6 per cent. per annum for the half-year on the preference shares, making 6 per cent. for the year.

MARKET QUOTATIONS.

Wednesday, August 31st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£9 10	..
a Copper Sulphate	,,	£18	..
a Lead, Nitrate	,,	£25	..
a ,, White Sugar	,,	£23 10	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	88/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70 %)	,,	£11	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b ,, Wire, in ton lots	,,	£112	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	6½d.	..
c ,, Tube (brazed)	,,	8½d.	..
c ,, ,, (solid drawn)	,,	7d.	..
c ,, Wire, basis	,,	6½d.	..
c Copper Tubes (brazed)	,,	9d.	..
c ,, ,, (solid drawn	,,	8½d.	..
g ,, Bars (best selected)	per ton	£71	..
g ,, Sheet	,,	£71	..
g ,, Rod	,,	£71	..
e ,, (Electrolytic) Bars	,,	£58 10	..
e ,, ,, Sheets	,,	£74 15	..
e ,, ,, Rod	,,	£63 5	..
e ,, ,, H.C. Wire	per lb.	7½d.	..
f Ebonite Rod	,,	6/-	..
f ,, Sheet	,,	5/6	..
m German Silver Wire	,,	1/8	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	8/4	1/3 dec.
l Iron Pig (Cleveland warrants)	per ton	49/2	10d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£12 15 to £12 17 6	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 12 6	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	1½d. dec.
p ,, ,, rolled strip & sheet	,,	1/1	1d. dec.
o Platinum	per oz.	130/-	..
e Silicium Bronze Wire	per lb.	8½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£158 to £159	£6 10 inc.
n ,, Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh's (Vieille Montagne bnd.)	,,	£27 5	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Gandy Belt Manufacturing Co., Ltd.—An interim dividend at the rate of 6 per cent. per annum is announced.

Mackay Companies.—The directors have declared the usual quarterly dividend of 1¼ per cent. on the common shares.

Blackpool and Fleetwood Tramroad Co.—The half-yearly meeting of this company was held on August 25th, at Blackpool. Mr. R. H. Prestwich, the deputy-chairman, who presided, mentioned that rates and taxes showed a decrease as against last year, brought about by the company's success in the litigation against Bispham Council. During the half-year 997,574 passengers were carried, an increase of 93,000 over the corresponding period of the previous year. The earnings only increased by £76. During the past half-year they had again been very fortunate and free from accidents. The chairman then formally moved that out of the available balance of £5,228 a dividend be paid at the rate of 4 per cent. per annum, absorbing £3,000; and that £750 be written off to be placed to depreciation account, thus leaving a balance of £1,028 to be carried forward. This was seconded by Mr. Greenwood and carried.

STOCKS AND SHARES.

Tuesday Evening.

Markets have got into rather more cheerful channels, and the evidence of abundance of money that was revealed by the carry-over on Monday is no doubt a reason why investment issues have turned the corner of their recent depression.

That there must be an early rise in the Bank Rate is regarded as inevitable, but its effect seems to have been discounted so far in advance that the actual fulfilment of the event may be succeeded even by a recovery, instead of a fall, in prices.

The electricity supply department has been greatly interested in the reply made by the Charing Cross and Strand Company to the excursion of the Gas Light and Coke people into the domain of the Westminster Electric Supply undertaking. (Incidentally, there are some, no doubt greatly ill-informed, who wonder why the Charing Cross Company should take up the cudgels, instead of the actual victim of the attack.) The retort of the Charing Cross and Strand is applauded for its clever defence and fighting spirit, but it has had no particular effect upon the price of the Westminster shares, which are ¼ better on balance. However, the parcel that formed the immediate cause for the weakness of the latter has now been placed, and so the market is in so much the better position on that account.

Other issues in this market are little altered. Edmundson's Preference rose ¼, and the Mexican descriptions are slightly easier.

Last week we gave a couple of short tables showing the yields upon a group of Canadian-Mexican bonds. The annexed list gives a few of the Debenture stocks obtainable in the market at the moment. It must again be remarked that redemption is not allowed for in working out the returns:—

Electric Debenture Stocks.

Description.	Price.	Yield.	Interest payable.	Redemption.
Bournemouth and Poole 4½ %	103	£4 7 6	1 Jan.-July	Any time at 107.
Charing Cross 4½ %	102½	4 8 0	15 Jan.-July	1941 at 100, or earlier at 102.
Central 4 % Guaranteed	102 free	3 18 6	1 June-Dec.	1931 at 100, or earlier at 110 (guaranteed by St. James' and Westminster Companies).
County of London 4½ % 1st	107	4 4 0	1 Jan.-July	Any time after 1923 at 115
Electric Construction 4 % 1st Mort.	62½	6 8 0	15 Jan.-July	Perpetual.
Electric Supply Co. of Victoria 5 % 1st Mort.	89	5 12 6	1 Jan.-July	By annual drawing at 105 or by purchase under that price.
South Metropolitan 4½ % 1st Mort.	100	4 10 0	1 Apr.-Oct.	1931 at 100, or after 1915 at 110.
Vera Cruz 5% 1st Mort. Debs. (Issued at 91½.)	92½	5 8 0	1 Jan.-July	By sinking fund commencing 1916 at par or by purchase under par.

The Telegraph list is good, especially as regards the Anglo-American issues. Investment proceeds steadily, and the supply of floating stock is being absorbed at a pace which is almost rapid. Dealers find that, having sold stock, they cannot buy it back, and are compelled to mark up the prices against themselves, in the hope of attracting sellers to the market. Direct Spanish shares and Debentures have hardened. Western Telegraphs gained ¼, and the American group is very materially better. Rumour still swings backwards and forwards with regard to the negotiations of the Anglo-American with the American Telephone and Telegraph, but it is taken as indisputable that some kind of definite arrangement is certain to be reached. The latter company's stock has eased off a point. Direct United States shares have gained 15s. Mackay Companies' common stock rose 2, and Globe Ordinary at 10¾ shows a 5s. advance. National Telephone Deferred is ½ down.

In spite of the increase of investment business, the Home Railway market continues lumpish, with only occasional flashes of improvement to animate it. Central London Deferred fell 2 on a slight pressure to sell. Districts and Metropolitans are also on the lower side. The travesty of a summer such as we have suffered this year has done much to subdue the traffics of the underground lines. The investor has not gone so far as to take up electrical stocks yet, but is confining his attentions more to those of the steam companies.

Traction descriptions are quiet and more or less lifeless for the time being. British Columbia Deferred is a trifle easier, but the Preference gained ½. Mexico Trams have risen a point, and Calcuttas ½. Industrials are steady. Henley's Debenture again improved. Brush Second Debenture at 24 is 1 lower. Castner-Kellners have retained their rise, and Babcocks are rather better. The Rubber share market is dull to stagnant, without any sign of revival.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 23rd.	Closing Quotations Aug. 30th.	Business done week ended Aug. 30th, 1910.		Rise + or Fall —	Present Yield per cent.
			1906.	1907.	1908.	1909.			Highest	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3½	3⅜ — 3⅞	..	..	..	Nil.
286,500	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	95 — 97	95 — 97	..	..	..	4 17 7
255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	137 —140	136 —139	..	..	—1	5 15 1
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 8
558,460	Anglo-American Telegraph	Stock	3⅞%	3½%	£3 4s.	3⅜%	64½ — 66½	67⅜ — 69½	..	..	+3½	5 4 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	106— 108½	110 —112	109	106½	+3½	5 7 2
3,220,770	Do. do. do. Deferred	Stock	1⅜%	1 %	8/-	25/-	25⅝ — 26⅛	27⅜ —27⅞	28⅛	26 1/16	+1⅛	4 10 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101½—103⅝	101⅛—103½	..	..	..	4 16 7
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	9⅛ — 9⅜	9⅛ — 9⅜	..	..	..	4 3 1
2,449,176	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	85¼	84½	..	4 13 0
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8¾ — 9	8¾ — 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16⅜ — 17½	16⅜ — 17½	..	..	..	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜ — 3⅝	3⅜ — 3⅝	..	..	+ ⅛	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	+ ⅛	5 19 5
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	100—102	..	..	+1	3 18 5
60,710	Direct United States Cable	20	4⅝%	4½%	4½%	4 %	14⅝ — 15⅝	15⅛ — 16	15⅝	..	+ ⅛	5 0 0
36,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	132 —135	132 —135	134⅜	132½	..	5 3 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	84⅝	84½	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	102⅜—104½	102⅜—104⅝	104	103	..	3 16 7
300,000	Eastern Extension, Australasia, and China Tele. ..	10	7 %	7 %	7 %	7 %	12⅝—12⅞	12⅝ — 12⅝	12 1/16	12⅜	..	5 8 9
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	99½—102½	99⅛—102⅝	..	..	..	3 18 1
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	100¼	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5⅛%	5⅝%	5⅜%	5⅛%	10½ — 10⅝	10⅛ — 11	10⅜	10⅛	+ ⅛	5 6 6
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13 — 13⅛	13 — 13⅜	13⅛	13 1/16	..	4 8 11
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	29½ — 30⅜	29⅞ — 30⅜	..	..	..	6 8 0
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	53 — 55	53 — 55	..	..	..	6 15 3
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	84 — 88	86 — 89	..	..	+1½	4 15 6
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 78	74 — 78	..	..	..	5 2 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	⅝ — ¾	⅝ — ¾	..	..	..	6 4 8
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	⅝ — ¾	⅝ — ¾	..	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104 —105½	104⅝	104	..	5 13 9
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123½—125½	123 —125	123½	123½	—1	4 15 0
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	10⅜	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97½ — 99½	97⅝ — 99½	97⅛	..	..	3 10 4
1,983,598	Do. do. 4 % Deb. Stock Red.. ..	100	4 %	4 %	4 %	4 %	98¼—100⅛	98¼—100⅛	99⅛	98⅜	..	4 0 0
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	7 %	8 %	8 %	8 %	1⅛ — 1⅜	1⅛ — 1⅜	30/6	..	..	4 18 6
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	96¼ — 98½	96¼ — 98½	..	..	..	4 1 3
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
3,042	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	130—133	130 —133	..	..	..	4 10 3
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞ — 7⅛	6⅞ — 7⅛	7 1/16	..	..	5 12 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅛	..	..	..	4 11 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	96½ — 98½	96½ — 98½	..	..	..	4 1 3
207,930	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	7 %	13⅞ — 14⅜	14 — 14⅜	14⅜	14¼	+ ⅛	4 16 7
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100—102	100—102	101	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1⅛ — 1⅜	1⅛ — 1⅜	13/9	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	8⅝ — 9	8⅝ — 9	8⅝	..	..	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14⅜%	8 — 9	8 — 9	8 1/16	..	..	16 12 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100—102	100—102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4 1/16— 4 1/16	4 7/16— 4 1/16	90/7½	89/4½	..	5 6 8
800,000	Do. 5 % 2nd Pref., 800,000 to 1,800,000	5	..	..	..	5 %	4¼— 4⅜	4¼— 4⅜	85/-	..	..	5 14 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90½ — 92	91 — 92½	92	90⅜	+ ⅜	4 6 6
392,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	24 %	5⅝ — 5⅝	5 7/16— 5 1/16	5 1/16	..	+ 1/16	4 5 4
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	3 19 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 9 7
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	8 %	8 %	8 %	144 —148	143 —147	146½	..	— 1	5 8 10
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	124 —128	124 —128	126½	126	..	4 13 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109½—112½	110 —113	112½	111½	+ ½	4 8 6
233,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	½ — 1	½ — 1	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	Nil	2⅝ — 3⅛	2⅝ — 3⅛	57/6	..	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 90	86 — 90	..	..	..	5 11 1
628,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 73	68 — 73	69	..	..	6 3 8
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞ — 6⅛	5⅞ — 6⅛	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	1/16— 1/16	1/16— 1/16	..	..	..	Nil
1,816,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	61 — 63	61 — 63	62	..	..	6 7 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16— 1/8	1/16— 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref... ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	23 — 27	22 — 26	..	..	—1	17 6 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4 — 4½	4⅛ — 4⅜	85/-	..	+ ⅛	5 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4 1/16— 4 1/16	4 1/16— 4 1/16	87/6	..	..	5 1 3
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9 — 10	9 — 10	..	..	..	5 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	4 15 3
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	2 1/16— 2 1/16	2 1/16— 2 1/16	..	..	+ ⅛	4 5 6
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	64 — 66	64 — 66	65⅛	64	..	4 10 11
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	86⅛	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	49 — 51	47 — 49	49	..	—2	4 1 8
1,460,000	City and South London Railway	Stock	2½%	2½%	1½%	1½%	27 — 28	27⅝ — 28⅛	27 1/16	27⅛	+ ⅛	6 2 10
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	¼ — ½	¼ — ½	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	84— 87	83 — 86	..	..	—1	5 16 8

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Aug. 23rd.	Closing Quotations Aug. 30th.	Business done week ended Aug. 30th, 1910. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,089	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜— 13⅜	12⅜— 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	2½%	Nil	Nil	1/16— 1/16	1/16— 1/16	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	4½%	2½%	Nil	Nil	1 — 1⅛	1 — 1⅛	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	..	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/16— 1/16	1/16— 1/16	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1⅛— 1⅛	1⅛— 1⅛	22/6	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7⅜— 8	7⅜— 8	..	..	..	6 5 0
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	½%	Nil	Nil	¾— 1	¾— 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½— 10⅝	10½— 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12¼— 12⅝	12¼— 12⅝	12¼	..	..	5 16 6
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	+ ⅛	4 5 9
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	105½—107½	106 —108	108	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14½— 15	14½— 15	..	..	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	⅛%	Nil	Nil	13/16—15/16	13/16—15/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 5⅛	4⅞— 5⅛	..	..	— ⅛	9 10 6
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	3 %	Nil	..	1⅛— 2⅛	1⅛— 2⅛	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1⅛— 2⅛	1⅛— 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3¾%	..	2 — 2⅛	2 — 2⅛	41/3	..	..	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 71	67 — 71	69½	..	..	5 12 8
5,732,062	Metropolitan Consolidated	100	1 %	¾%	¾%	1 %	38 — 38½	38 — 38½	38½	37⅞	..	2 12 0
2,640,914	Do. Surplus Lands	100	2¾%	2¾%	2¾%	2¾%	65 — 67	65 — 67	66	65	..	4 2 1
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	20¾— 21	20⅞— 20⅞	20⅞	20⅜	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	5%	⅜— ⅝	⅜— ⅝	..	..	..	5 15 0
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/16— 3/16	1/16— 3/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	¼— ⅜	¼— ⅜	..	..	..	5 14 3
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	96⅜	..	..	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	119 —121	121 —123	120½	118	+2	4 17 7
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5%	99½—100⅜	99⅝—100⅜	100¼	99⅜	+ ⅛	4 19 8
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	3/16— ¼	3/16— ¼	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	¼— 5/16	¼— 5/16	11/3	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	34 — 36	34 — 36	35⅜	..	..	5 16 8
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100	..	..	3 18 5
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	103 —104	103 —104	103½	..	..	4 16 2
2,800,000	Do. do. 4½ % Bonds	..	..	..	4½%	4½%	89 — 91	89 — 91	..	..	..	4 18 11
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	39 — 41	39 — 41	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	⅜— ½	⅜— ½	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1¼— 1⅜	1¼— 1⅜	..	..	..	8 11 5
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	6⅞— 7⅛	6⅞— 7⅛	7⅛	..	..	6 15 7
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	4 15 9
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅜— 3⅞	3⅜— 3⅞	70/-	..	..	6 9 0
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛— 4⅜	4⅛— 4⅜	87/6	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝— 4⅛	3⅝— 4⅛	..	..	..	4 17 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 2 6
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅜— 4⅛	3⅜— 4⅛	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11⅛— 11⅝	11⅛— 11⅝	11⅝	11⅛	..	6 0 5
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅛— 12⅛	11⅛— 12⅛	..	..	..	4 19 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	120 —124	120 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99½—102½	99½—102½	..	..	..	4 7 10
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1⅝— 2	1⅝— 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅜— 3⅛	2⅜— 3⅛	..	..	..	7 13 10
260,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94⅛— 96⅜	94⅛— 96⅜	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 7⅞	7⅝— 7⅞	..	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜— 11	10⅜— 11	7 11/16	..	..	5 9 1
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	11	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	106¼	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	Nil	1/16— ⅛	1/16— ⅛	101⅛	101⅛	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	Nil	1⅛— 1⅜	1⅛— 2	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	75 — 78	75 — 78	35/-	..	+ ½	5 15 5
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	85 — 88	85 — 88	76½	75½	..	5 8 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4¼— 4⅜	4¼— 4⅜	86½	86½	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7⅛	7 — 7⅛	..	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅝— 2	1⅝— 2	..	..	..	4 8 11
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	5/16— 5/16	5/16— 5/16	..	..	..	5 12 11
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4½%	4 %	4 %	90 — 92	90 — 92	..	..	..	4 7 7
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3¼— 3⅜	3¼— 3⅜	70/7½	66/3	..	7 8 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4 — 4⅛	4 — 4⅛	..	..	..	5 0 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	84½— 85½	84½— 85½	85⅛	85½	..	5 16 7
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3½%	4 %	79 — 81	79 — 81	80½	79	..	4 18 9
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	103½—105½	104 —106	105½	104½	+ ½	6 12 1
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	93½— 94½	93 — 94	94	93⅜	..	5 6 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95½— 97½	95⅞— 97½	..	..	..	4 12 4
120,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	3⅞— 4⅛	3⅞— 4⅛	..	..	..	2 10 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅛— 4⅜	4⅛— 4⅜	..	..	..	5 5 3
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	100 —102	100 —102	..	..	..	4 18 0
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	7 %	12 — 13	12 — 13	..	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	7 %	6⅝— 7⅛	6⅝— 6⅞	..	..	..	5 1 10
119,894	River Plate Electy. Co. Ord.	Stock	2½%	6 %	8 %	9 %	210 —225	210 —225	..	..	..	4 0 4
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	105 —115	105 —115	..	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	7⅜— 8⅛	7⅜— 8⅛	..	..	..	6 1 3
80,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅝— 7⅛	6⅝— 7⅛	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	..	..	..	4 1 5
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅛— 2	1⅛— 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅝— 2⅞	2⅝— 3	..	..	+ ⅛	6 13 4
130,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	102	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	3/16— ⅜	3/16— ⅜	..	..	..	6 13 4
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1/16— 1/16	1/16— 1/16	..	..	..	6 11 9
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾— 1	¾— 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	⅜— ⅝	⅜— ⅝	..	..	..	5 14 3
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	.. %	7⅞— 8⅜	8 — 8⅛	7⅞	..	..	6 1 3
£1,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. June 9th. 1910.

COAL-CUTTING MACHINERY AND ELECTRICAL ACCIDENTS IN MINES.

(*Concluded from page* 325.)

The third accident is still more instructive as showing the unreliability of "earthing," no matter how carefully this may be attempted to be done through the armouring. The accident occurred at Denby Colliery, and resulted in the death of a pump attendant. It appears that a 24-kw. 220-volt continuous-current generator had been used for some years for lighting and driving an underground pump, but more recently a 250-kw. 3,000-volt three-phase generator was installed for the purpose of driving five electric motors on the surface, and two haulage motors underground. For the latter purpose the current is taken down the pit at the full pressure and carried a distance of 1,440 yards inbye, where it is transformed to 550 volts, after which it is taken a distance of 900 yards to an endless rope haulage motor, and then a further distance of 800 yards to a small single drum haulage. The latter had only been installed, and though a few trial runs had been made, it was not actually started, but everything electrical appeared to be satisfactory. A mechanical pull-wire signal, however, did not work satisfactorily, and the deceased was sent by the manager to the motor house to put it right. A man some 16 yards away saw him enter the motor house "and in about half-a-minute to a minute heard the deceased drop his lamp and found him apparently clinging to the wall at the right side of the house and gradually settling down. He, at the same time, saw bright flashes and sparks coming from the vicinity of the ammeter, and, therefore, did not go into the house, but sent for the deputy, who was 120 yards away, and he came at once. The deputy sent the man to get the current switched off at the top haulage house, *800 yards away, where the nearest switch was.* The man ran as hard as he could up a stiffish gradient for about 600 yards, and then, being out of breath, sent another man forward and returned to the scene of the accident. The man who had been sent forward followed him, and informed the deputy that the current had been switched off. *All this had taken a quarter of an hour, and even in that time had been most expeditiously done.* The deceased man was then got out, and artificial respiration was tried for from 1¾ to 2 hours, until a doctor came and pronounced life to be extinct." The italics are ours. It is scarcely believable that anyone would install an electric haulage without putting in a main switch between the leading-in cable and the switchboard. Had this switch been provided and left out, as it ought to be when the machine is standing, the accident would not have happened; but in any case, to have to send 800 yards away to switch off the current is simply inviting disaster should anything go wrong.

On examination, it appeared that the sparking was due to the insulation of the coil of the ammeter breaking down, and causing arcing between it and the back of the casing, and it seems probable that the deceased on observing this had got a screw-driver and commenced to take out the screws to see if he could find out the cause, but without first causing the current to be switched off. One of the screws was found about ¾ in. out, and the other two were so loose that the ammeter could be rocked backwards and forwards on the switchboard. The cables, however, "are armoured, and the whole system is earthed through the armouring to numerous earth-plates both above and below ground, many of them in damp places, and the difficulty was to account for deceased having received a shock under such conditions." The joint-box in the motor house was connected by a piece of wire to another four-way box, and on this piece of wire depended the earthing of the whole system, as it connected the armouring of the cable from the motor house to that from the transformer house, and the nut securing this piece of wire was found slack, so that the wire could be moved slightly. Consequently, assuming that the man did not interfere with the ammeter, if the earthing was defective it would be ; ssible for the frame of the motor to become charged, and as he would touch it with his leg, he would receive a shock directly he put his hand on the pull signal wire as this was earthed along its whole length. On the other hand, Mr. Nelson was of the opinion that the deceased on attempting to take down the ammeter, would, by destroying the contact between the back of the ammeter case and the switchboard frame, receive a fatal shock.

Whichever of the two theories is the correct one, the fact remains that the arrangement was bad, and had the installation been put down on right lines the accident would not have happened. Another point in connection with it shows that very great care should be taken with the insulation of ammeters and voltmeters for underground purposes, and they should be very carefully covered with waterproof wrapping to prevent the effect of the humid conditions of the atmosphere below ground.

As regards the non-fatal accidents, the details given are not sufficient to admit of much criticism, but some were pure accidents, and could not be prevented under any circumstances. In the first, some tubs had got off the road and broken an incandescent lamp, and a man walked under it in order to lift on the tubs, and in so doing his back came in contact with the wires, and he got a shock. A second man who tried to pull him away also got a shock. The place was wet.

In the second, a coal-cutting machineman received a shock owing to a leakage on the machine; in the third, a trammer pulling at a hauling rope received a slight shock due to a leakage from the armature on the motor. In neither case is it suggested how the leaks were caused. The fourth was a pure accident, as a cable had been damaged by a fall of stone, which left a bare place, and a loader inadvertently touched this whilst getting out of the way to allow a pony to pass. There is one point, however, which is not explained, and that is, if it was known that there had been a fall, why was not the cable at once examined and repaired?

In the next accident a driver boy put his thumb inside a lampholder, and not only received a severe shock, but his thumb was badly burnt. It is, of course, a very difficult matter to overcome curiosity of this description, and the colliery electrician has to be constantly on the alert to see that everything is so secured that if anyone does touch anything, nothing will happen. The same remarks also apply to the sixth accident, in which a trammer received a slight shock and a burn about the thumb and fingers of his right hand when picking up his water-bottle, which had been attached to a fuse on the switchboard by a piece of wire as a "lark" by some other boy or boys. The latter should have been found and prosecuted.

Another fatal accident—though not classed under electricity—occurred through an old type of gate end box being in use. This was loose, and was moved about from place to place and attached to the terminals of the main cables at the gate ends. The terminals were bare and attached to a table, and when not in use, they were merely covered over by a piece of wood, and it is surmised that the man, in attempting to lift the box on to the table, touched one of the terminals with it and received a shock which caused him to be knocked down and his skull fractured. On the other hand, his feet may have slipped on a rail behind him; but judging from the arrangement, the former explanation seems the more feasible. The point about the accident, however, is this, that Rule 30 requires that "where flexible conductors are joined to the main cables, a *fixed* terminal box must be provided," and though this installation was put in two years before the special Rules came into force, no notice had been taken of them.

Of the two non-fatal accidents in No. 9 District, in one a motorman had his hand slightly burned by throwing on an overload cut-out switch before opening his main switch; and in the other, the motorman attempted to start a three-phase motor on full load by throwing his switch into the running position, but realising his mistake, he switched off, causing an arc which burned his hand and wrist slightly. Both of these accidents were undoubtedly due to forgetfulness on the men's part; and such occurrences as these cannot well be avoided.

In No. 11 District the first accident occurred to a haulier who attempted to connect the two ends of a 250-volt lighting cable, which had been severed. It was no part of his duty to interfere with or touch the cable; the matter should have been reported to the electrician.

In the second case two men were killed through touching a cable. The cable was three-core, bitumen insulated, and armoured with a single layer of galvanised iron-wire. This had been damaged by a number of runaway trams, and the electrician had cut away the armouring at what appeared to be the part most damaged, and connected the cable to earth at that point. On the day of the accident, however, the insulation must have broken down elsewhere, for as the deceased was alighting from a tram he took hold of the cable and received a shock which caused his death. The second man was not seen to touch the cable, but it is assumed that he received a shock in the same way. This accident again shows how difficult it is to secure efficient "earth" by armoured cables. Had they been *unarmoured* cables the men would not have been killed.

Of the non-fatal accidents, particulars are only reported of two, one in which an electrician received a burn on his fore-arm from a short circuit of two brushes on either a motor or dynamo; and the second in which a pump-man received a shock and slight burning on the left hand whilst pulling the ordinary signal wire which was hanging on the same side of the roadway as the cable, and with which it came in contact with a damaged part. It is again significant to note that "the earthing was found to be faulty" in connection with this accident.

In No. 12 District no accidents were reported, but Mr. Martin reports very favourably of its adoption at several mines, and states: "The use of electricity in the mines of the district continues to increase"—but it is discouraging to read, "At the various mines where it has been in operation, it has been continued, except, I believe, at Wheal Busy, where those responsible for its adaptation have not in anyway benefited themselves nor anyone else *by the manner in which things were carried out.*" Thus it is always, when electricity is termed unsatisfactory or dangerous, very little investigation is enough to show that it is not the fault of electricity, but of the way it is installed and used. Most of the accidents chronicled above would have been avoided, while the Wheal Busy Co. would undoubtedly have reaped the benefit in pounds, shillings and pence, had a little more care, and probably a little more money, been expended, and some ordinary engineering common-sense exercised in its installation. If the colliery or mine management do not know anything about it, then why not employ some competent engineer who does? He would, at any rate, earn his salt, but in all probability his salary would prove to be the best paying of all the capital employed in the undertaking. On this point, however, we cannot do better in conclusion than again quote Mr. Martin, who says:—"I cannot too strongly impress upon those who contemplate the adoption of electricity the importance of consulting an electrical engineer of experience in connection with mining, and possessing ability, to advise them on the most suitable plant for their individual requirements, and to watch over the erection of the machinery and the laying of the cables. Not even the lighting plant, whether taken from high or low-tension, should be laid in without his approval; even with his approval—if he would give it—the lighting of double partings or sidings or other places some distance in-bye from the high pressure supply is undesirable and more or less unsafe. If this practice is carried out in any of the mines in this district, I hope the matter will receive very careful consideration, as it does not seem to be a safe practice, owing to the danger of persons coming in contact with the wires.

"In this way much of the disappointment which occurred in the past, owing to mechanics or engineers at mines taking upon themselves the position of electrical engineers, might have been prevented."

Peterborough.—A L.G.B. inquiry was held on August 23rd into the application of the T.C. for a loan of £2,100, £1,120 being for mains extensions, £310 for street lighting, and £670 for superheaters, boilers, feed-water meter, and station wattmeter. There was some opposition by ratepayers on the ground that energy was supplied to the tramway company at what he claimed was a loss, viz., 1½d. per unit, but the Town Clerk explained that that figure had been fixed by the Board of Trade inspector, who acted as arbitrator.

REVIEWS.

General Lectures on Electrical Engineering. By C. P. Steinmetz. London: Crosby Lockwood. Price 8s. 6d. net.

This book is made up of 17 lectures and two appendices. The treatment is very general and deals with the problems of generation, control, transmission, distribution of energy, &c. There are some remarks on the design of the apparatus employed, though little detail is entered into. In addition, the method is entirely descriptive throughout, with an entire absence of mathematics. In general, the work is a sort of summary of the advantages and disadvantages of various systems, types of control, &c., and is useful because it places before the reader, who may be undecided as to the most suitable scheme to adopt, a plain statement of the case for each. As will be understood, therefore, the author lays no claim to comprehensive text-book treatment of the subjects discussed, and, with regard to this, the prospective reader must be under no sort of illusion. The principal points of the lectures may be mentioned in consecutive order.

(1) Is a general review of the main uses of electrical energy, and discusses the change of frequency that has occurred in recent years, distribution for lighting and power, comparison of A.C. and D.C. current, and loss of power in various types of circuit. (2) Is on general distribution (both D.C. and A.C.), and gives diagrams, a list of apparatus used in each system, and the losses involved under each. (3) Deals with light and power distribution, and compares generally D.C. and A.C. systems. The primary distribution systems are then mentioned, and some details of low-tension systems are gone into, including comparison of two-wire direct-current and single-phase 110-volts, three-wire direct-current and single-phase 110-220 volts, four-wire two-phase, three-wire two-phase, three-wire three-phase, five-wire two-phase, and four-wire three-phase. (4) Is on load factor and cost of power. The cost of power at the consumer's meter is divided into three parts, and each is gone into in detail. The load factor is well discussed, and the interesting fact noted that electro-chemical work gives the highest load factor, frequently some 90 per cent., while a lighting system shows the poorest load factor, being occasionally, in an A.C. system without motor load, as low as 10 to to 20 per cent. (5) Deals with long-distance transmission, with special reference to the various voltages in common use, losses in line due to high voltage, lines and transformers, and high-voltage disturbances in transmission lines. (6) Has to do with higher harmonics of the generator wave, and deals with their origin and effects on transformers and synchronous machines. (7) Discusses high-frequency oscillations and surges. (8) Is on generation, and compares the various prime-movers. It is interesting to note that the author has only one objection to the steam turbine—namely, that it is a new type of machine, and operating engineers are, therefore, less familiar with it than with the reciprocating engine; hence there is a difficulty in getting sufficient men to intelligently install and operate it. The author is no lover of the gas engine, and gives as his reasons it lower reliability, higher cost of maintenance in attendance, repairs and greater depreciation, larger size and space occupation for the same output, less ease in starting, and lower steadiness of rate of rotation. (9) Deals with the hunting of synchronous machines. The general causes of hunting are given as magnetic lag, pulsation of engine speed, hunting of engine governors, and wrong speed characteristic of engine, and these are treated in detail and the remedies stated. (10) Has to do with regulation and control, and considers chiefly A.C. systems. (11) Discusses lightning protection. (12) Deals with the electric railway, and gives a summary of the characteristics of the railway motor and typical classes of railway service. It discusses at some length speed time curves. (13) Has to do with details of the railway motor. (14) Deals with the alternating-current railway motor, and leading characteristics of many types are instructively compared. (15) Is on electro-chemistry. Electrolytic work, metal reduction and seconda y products are taken in order. (16) Is devoted to the incandescent lamp, and the new types receive notice. (17) Deals

with arc lighting. Appendix I is on light and illumination, and is a paper read before the Illuminating Engineering Society on December 14th, 1906. This is a general *resumé* of the question to date. Appendix II is on lightning and lightning protection, and is a paper read before the Annual Convention of the National Electric Light Association in 1907. It deals with lightning phenomena in the clouds, lightning in electric circuits, and lightning protection of electric circuits.

The book, as a whole, contains much information of a kind only usually found after much hunting through papers contributed to the learned Societies.

The mechanical get-up is, however, not quite up to our English standard, the paper being coarse and of the blotting-paper variety, and in consequence the illustrations and squared-paper diagrams are somewhat blurred.

Engineering Workshop Machines and Processes. A handbook for the use of technical students. By DIPL.-ING. F. ZUR NEDDER. Translated and revised by John A. Davenport, M.Sc., with an introduction by Sir Alexander B. W. Kennedy. London: Constable & Co., Ltd. Price 6s. net.

It is not easy to criticise a book upon which so eminent an authority on engineering education and practical work as Sir Alexander Kennedy has bestowed a blessing. On the other hand, we should be failing in our duty if we permitted the words used in the introduction to bias the mind whilst perusing the pages which follow. Putting the matter bluntly, we think that the student who purchases this book will not obtain good value for his money. The purpose of the author is admirable. It is to give the young apprentice or pupil an idea of the various processes which go to make up the "workshop practice" of modern engineering science. Pages 14 to 64 deal with Elementary Metallurgy—under the heading "Materials of Construction." Then follow about 20 pages devoted to the work of the foundry and the pattern shop, and an equal number devoted to forging and smiths' work. About 40 pages are devoted to a description of the tools used in the machine shop. Short chapters of about 10 pages each are obviously insufficient to deal with "Measuring and Marking off," and "Fitting, erecting and testing." As an appendix, which occupies 36 out of a total of 207 pages, there is the report of the Institution of Civil Engineers on the education and training of engineers. This might well have been condensed.

The book has one admirable feature; it mentions prices. From a literary point of view the translator has succeeded; the language used is well selected and simple. But what shall we say of a book for engineering students on this subject which contains four illustrations? A good commencement is made; fig. 1 (due to the translator) is a plan of Messrs. W. H. Allen & Co.'s works at Bedford. Fig. 2 is a rather feeble representation of the section of a blast furnace; fig. 3 is the same sort of thing (this time it is a Bessemer converter); fig. 4 is quite good, and does not waste space. But why were not the illustrations—line drawings, of course, and *not* catalogue blocks—continued? Fifty sketches in the chapter devoted to a description of the machine shop would have been welcome. The only books to which this one can be compared are Shelly's "Workshop Appliances" (now, unfortunately, much out-of-date), and a book at about half a guinea on mechanical engineering. There was room for a treatise which improved upon these others, and there was ample opportunity for improvement. The saddening part of the matter is that the translator is obviously capable of writing such a book. We do not altogether despair that he will do so. If he will accept these few suggestions as coming from one who knows full well the tiresome labour of technical text-book writing; of one who sympathises with the man who translates; of one, who above all else, wishes to see the technical students obtain help and assistance for their work by means of really good text-books; then he will know that this is no endeavour to belittle the many hours of wearisome efforts spent in making us understand easily in English what the author wrote for his own countrymen. It would have been much better to have extended the descriptive portions of the book and to have omitted the appendix. Nowadays the technical student expects and obtains a great deal for six shillings. It is not a question of the author's time, or the expense to the publisher; it is what does the student obtain for his money? Judged by that standard we reluctantly write the book down as disappointing. There is yet a splendid opportunity for the translator to use it as the foundation of a most excellent treatise on the subject.

The Compulsory Working and Revocation of Patents. By ERNEST LUNGE, of Gray's Inn and the North-Eastern Circuit, Barrister-at-Law. London: Stevens & Sons. Price 3s. 6d.

The new Act, which renders the working of patents essential to their continued existence, is still on its trial. The work before us gives us a most interesting and instructive summary of the trial up to the present time. In his preface the author points out that compulsory working is no new thing. He writes that the fate of Perillos provides an early example of the difficulty of reconciling the interests of inventors with Governmental compulsion to work their inventions. Perillos, a brassfounder of Athens, domiciled at Agrigentum, in Sicily, constructed a brazen bull larger than life, capable of containing a human victim, and so contrived that, a fire being placed beneath the bull, the unhappy man was gradually burnt to death, whilst the agonising cries which he uttered, before death came to his relief, were said to resemble those of a bull. The full-sized working model was exhibited to Phalaris, the tyrant of Agrigentum, who, wrapped in admiration of this instrument of torture, caused the inventor to make the first trial of it himself. Thus, in or about 570 B.C., Perillos, the inventor, experienced the perils of inventorship under the first essay of statesmen in "compulsory working." Mr. Lunge goes on to point out that nowadays "compulsory working" amounts, broadly speaking, to the principle of penalising an inventor with forfeiture of his patent unless he manages to put his invention into practice within the realm for which the patent grants him a monopoly of manufacture.

His work contains, first, a historical sketch showing that "Compulsory Working" was the basic idea of the early British patent system, and that (whether for good or for evil) the Act of 1907 has substantially taken us back to the recognised patents policy of Elizabeth and the Stuarts.

In the second place, the writer has attempted to provide a practical guide covering every matter connected with the law and practice under the compulsory working section of the Act of 1907. The Comptroller-General of the Patent Office, and the Judge to whom appeals from the Court of the Comptroller are assigned, have been entrusted with the constructive task of building up a practical working measure out of Sec. 27, which in itself is merely a so-called skeleton provision, and the writer has incorporated in a code many utterances of the Judge and Comptroller, which, strictly speaking, are *obiter dicta*, but were made with the express purpose of settling the practice.

A remarkable feature of this little work—as a law book—is the fact that it sounds a political note! The conflict between Free Trade and Protection is so inseparably bound up with the history of "Compulsory Working" during the past three and a half centuries, that the writer does not apologise for the "terminological" digression on page 26, *et seq.* It is there set forth that Sec. 27 of the Patents and Designs Act, 1907, is undiluted Protection, and irreconcilable with the tenets of orthodox Free Trade.

We can recommend the work to all who are interested in the compulsory working of patents.

Illumination and Photometry. By WILLIAM ELGIN WICKENDEN, B.S. New York: McGraw-Hill Book Co.; London: The Hill Publishing Co., Ltd. Price 8s. 6d.

In his preface, the author indicates that his intention in writing this book was not to produce a handbook of technical data nor a manual of practical instructions, but to attend rather to the scientific basis of the subject and to methods of rational analysis. He deals with the subject from all points of view, considering the production of light, the units and terminology employed, the principles of vision, the

representation and calculation of photometric quantities, photometers, arc lighting, incandescent lamps, vacuum tube illumination, lighting by gas, the principles of indoor and outdoor illumination, and gives many charts and tables for facilitating calculations.

The book is fairly free from literary faults, although we find "to closely approximate" (page 39), "to fairly represent" (page 44), "to thoroughly purge" (page 62); "tentalum" for "tantalum" (page 5); and such abbreviations as "times" for "multiplied by" (page 36); and "equals" for "is equal to" (page 45); and "back of" for "behind" (page 55). We also notice that where most people speak of a "milled" head, the author, with an attempt at meticulous exactitude, calls it a "knurled" head. "Knurl" means a humpback, and "nurled" is the word he was seeking. Further, we confess to a preference for the use of capitals when writing of the Wheatstone bridge or the Hefner candle. These terms are not analogous to the words ampere and volt, but indicate the person responsible for the thing mentioned.

From the technical standpoint, the book is very good, and should prove useful to many. Mr. Wickenden is not afraid to use mathematics considerably, and to expect a fairly high standard of mathematical attainment in his readers. This we think a praiseworthy characteristic, for one so frequently comes across authors who endeavour to write about highly complex and intricate subjects in a semi-popular way, so that, as they phrase it, their work "may be intelligible to those whose acquaintance with mathematics is slight." It is waste of time for any author who thinks at all highly of his subject, and who really wishes to impart information upon it, to attempt to write for the scientific reader and for the man in the street in the same book. It will be generally admitted that in photometry we have a science which, if it is to be understood properly, must be considered mathematically. The girls who work on photometers in lamp factories know how to use a photometer, but they do not, and do not need to, understand anything of its scientific bases.

Sometimes we wonder if Mr. Wickenden is a little sarcastic, or if he fails to observe a certain humour—whether intentional or otherwise we cannot be sure—which is apparent in some of his sentences. Examples of this are:—

"The principles of association and suggestion may operate to the great annoyance of the illuminating engineer, or may be employed by him to very great advantage." Quite so!

"In the hands of inexperienced and unskilled observers the Bunsen screen yields results as satisfactory as any other." This seems to be a tactful way of saying that all results obtained by such observers are useless.

The fact is emphasised that an accumulation of dirt renders photometers of the Lummer-Brodhun type more or less useless. This is surely true of any form of scientific apparatus which pretends to delicacy and fineness of operation.

"Coal gas . . . . . is of historic interest as having been the medium of the early development of the gas industry. Owing to the increasing scarcity of coal its commercial importance is declining." Poor old coal gas! We did not realise that its case was as bad as all that—in fact it certainly is not in England. Dealing with gas lighting, Mr. Wickenden ascribes much of its progress to the wholesome competition of electric lighting. This is a compliment which may be cordially reciprocated. The progress made by each is mutually due, to a very large extent, to the stimulus of competition. It is really remarkable, considering the host of difficulties involved in the operation of inverted gas burners, that they are as successful as they are. The anti-hygienic and dirt-causing properties of gas for lighting are dismissed too shortly, and the subject of sulphur is altogether neglected. Some figures relating to the life of incandescent mantles would be useful, but none are given.

Many considerations occur to the mind in reading a book of this kind. We have not space for more than a small fraction of them. One is, that in the continued operation of the Moore tube a gradual reduction of the pressure occurs, owing to the formation of a solid precipitate from the gas. What is this precipitate? Again, it is interesting to note that both the Moore tube and the alternating-current arc have inherently low power factors. The photometric utility of selenium, the bolometer, and the thermopile, is very interesting. Of course, it must be borne in mind that these things are susceptible to the total radiation, and not only to that visible part of it which is called light. We must be content with a passing mention of the novel Schmidt and Haensch flicker photometer, in which the lens revolves; and of the numerous forms of integrating photometers, of which the Ulbricht sphere appears to be the best; and of the intensive carbon arc, with its two positives and one negative. We have no hesitation in repeating that the book will be of great use to many, and it will certainly be interesting to almost everybody.

SOME EXPERIMENTS WITH THE REGULATION OF CIRCULATING WATER.

By W. N. Y. KING.

A LARGE surface condenser with about 4,000 sq. ft. cooling surface was recently installed to assist other condensers, of smaller size, to deal with the exhaust steam from a group of engines driving dynamos ranging from 250 to 1,500 KW. capacity.

Fig. 1 shows diagrammatically an end elevation of the condensing plant, the body of which was on the engine-room floor, and the air and circulating pumps, independently motor-driven, were on the basement level, 10 ft. below. The circulating suction and delivery mains were approximately at the level of the outside water supply.

TABLE I.

Outlet valve open.	Inlet valve open.	Water pressure leaving centrifugal pump.	Centrifugal pump motor.
5 turns.	35 turns	17·3* lb. per sq. in.	60 amperes
	25 "	17·3* " "	60 "
	15 "	17·1* " "	60 "
	10 "	16·5* " "	59 "
	8 "	16·1 " "	58 "
	7 "	15·8 " "	57·5 "
	6 "	14·8 " "	56·5 "
	5½ "	14·0 " "	55·5 "
	5 "	12·1 " "	52 "
	4½ "	10·0 " "	49 "

* Water running out of pump gland.

TABLE II.

Inlet valve open.	Outlet valve open.	Water pressure leaving centrifugal pump.	Centrifugal pump motor.
5½ turns	4 turns	15·8 lb. per sq. in.	51·5 amperes
	4½ "	13·8 " "	53·5 "
	5 "	12·5 " "	54·0 "
	5½ "	11·8 " "	54·0 "
	6½ "	10·8 " "	55·5 "
	7½ "	10·0 " "	56·0 "
	8½ "	9·3 " "	56·5 "
	10 "	9·0 " "	57·0 "
	15 "	8·2 " "	57·5 "
	20 "	7·9 " "	57·0 "
	25 "	7·9 " "	57·0 "
	35 "	7·9 " "	57·0 "

At times of ordinary full load, the condenser was capable of dealing with the whole of the exhaust steam without exceeding the lowest speed of the circulating pump, maintaining at the same time 26·5 in. of vacuum. The circulating inlet and outlet temperatures corresponding to this state were 56° F. and 91° F. respectively. Hence, at times when less steam was being exhausted, there was an excess of circulating water, which could not be reduced by decreasing the speed of the pump, so recourse was had to reducing the area of the openings of the inlet and outlet valves in the water pipes, and it was to determine with some working degree of accuracy what were the conditions obtaining with regard to pressure of water, power required to

drive the pump, vacuum, &c., in relation to the opening of the valves, that the following experiments were carried out. The instruments used were ammeters in the air and circulating pump motor circuits, and a pressure gauge (c, fig. 1) connected to the discharge pipe from the centrifugal pump. The latter was to give an indication of the

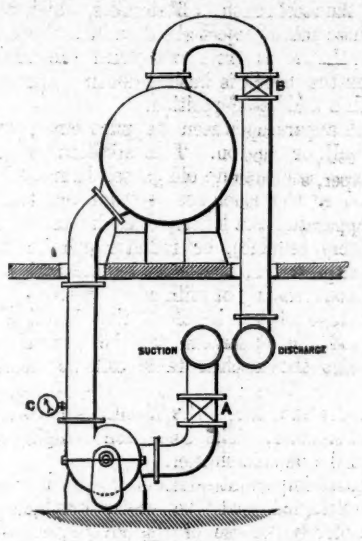


Fig. 1.

pressure to which the condenser tubes were subjected, an important point to know. Four groups of observations were taken as set out in the tables and curves appended. In the

TABLE III.

Outlet valve open.	Inlet valve open.	Vacuum in condenser.	Discharge from condenser. Temperature.	Circulating water outlet. Temperature.	Circ. pump motor.	Air-pump motor.
Turns.	Turns.	In.	° F.	° F.	Amps.	Amps.
6	4½	20·5	150	115	45	39
6	5	22·7	142	108	48	38
6	5½	23·5	132	99	49	37
6	6	24·3	126	94	51	36
6	6½	25·0	118	91·5	55	36
6	8	25·8	106	83·5	58	36
6	10	26·0	102	80	61	34·5

TABLE IV.

Outlet valve open.	Inlet valve open.	Vacuum in condenser.	Discharge from condenser. Temperature.	Circulating water outlet. Temperature.	Circ. pump motor.	Air-pump motor.
Turns.	Turns.	In.	° F.	° F.	Amps.	Amps.
6	5½	23·2	128·5	99	50	36
6½	5½	23·6	128·0	96	51	36
7	5½	24·0	128·0	94	51·5	36
7½	5½	24·1	125·0	93·4	52	36
8	5½	24·3	125·0	93·4	52	37
10	5½	24·2	125·0	93·4	52	37·5

Temperature of circulating water at inlet was 50° F. for Tables III and IV.

Note.—Air-pump motor ammeter readings are only approximate to 2 or 3 amperes, as the current fluctuated continually about this amount.

cases of Tables III and IV, a period of not less than 15 minutes was allowed to elapse between all adjustments, and the taking of readings, in order to allow a steady state to be reached :—

1. Outlet valve B was kept five turns open, inlet valve A was opened wide (35 turns), and shut down in stages at each of which readings were taken. Curves (*a*) and (*b*).

2. Inlet valve A was kept 5½ turns open. Outlet valve B was opened gradually, and at each step readings taken. Curves (*c*) and (*d*).

3 and 4. Inlet and outlet valves varied each in turn, with he other fixed, within a range suitable for ordinary working, and corresponding values of vacuum, temperatures of discharge to air pump, circulating water, &c., taken.

From the observations made, it is to be deduced from (1) that, as with fixed outlet the water pressure increases with opening the inlet valve, rapidly at first, and slowly after the latter is open rather more than the former, showing that at this point and beyond, the outlet controls to all intents and purposes, the quantity of water passed, there is no object in

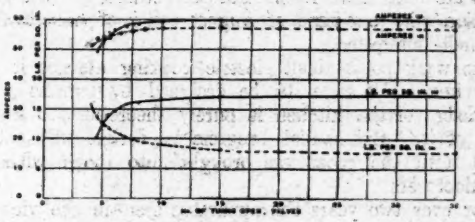


Fig. 2.

opening the inlet much wider than the outlet; and in order to avoid the pressure becoming so high as to cause the water to run from the pump gland, the inlet should not be kept wider open than the outlet.

The motor current increases in a similar way to the water pressure, which also points to the fact that it is desirable to keep the inlet less open than the outlet.

2. With fixed inlet, as the outlet valve is opened, more water passes and the pressure decreases rapidly at first until the latter is a little more open that the former (about 8 to 5½ turns), showing that the point is reached beyond which the inlet opening controls the supply, and there is no purpose served by further opening the outlet.

The current taken by the motor increases, as might be anticipated, with the increasing quantity of water passed, and reaches nearly a steady value at a time coinciding with that of the pressure. From these results it may be concluded that the circulating water should be controlled at the inlet valve, and the outlet valve should be given a little more opening than the inlet, in order to keep down the pressure in the condenser.

Experiment III shows how the temperature of the condenser discharge varies inversely as the degree of vacuum, and if a hot boiler feed is desired it must be obtained at the expense of the vacuum. A further point to be noted is that the degree of vacuum varies in inverse proportion to the power required to drive the air pumps, in consequence of increase in vacuum being accompanied by decrease of temperature, which reduces in turn the volume of vapour dealt with by the pumps.

Experiment IV appears to have a negative result, showing that once the outlet valve is wider open than the inlet, no advantage is gained by further opening (see 2). During the experiments, the load on the condenser was kept at a nearly constant average by isolating certain engines on it and keeping them loaded as steadily as possible, though the load itself fluctuated from instant to instant. The quantity of steam taken by the condenser was approximately 55,000 lb. per hour.

Legal.—British Westinghouse Electric and Manufacturing Co., Ltd., *v.* Ridings Arc Lamp Co. — This action came before the Right Hon. Sir Samuel Evans, sitting as Vacation Judge, on Wednesday last, upon a motion for an interlocutory injunction to restrain an alleged infringement of patent. Counsel stated that an injunction had been granted *ex parte* over that day, and the defendants now agreed to treat the motion as the trial of the action, submit to a perpetual injunction, an inquiry as to damages, delivery up of the infringing articles and to pay the costs. His Lordship accordingly made an order in those terms.

A New Flame Arc Lamp.—It is stated that the A.E.G., of Berlin, proposes to place on the market a new flame arc lamp for currents of from 8 to 12 amperes. The lamp is characterised by long lighting hours, which amount to 80 to 100, as compared with 16 hours in the case of flaming arcs of the ordinary type. It is said that the advantages of the lamp principally consist in the reduction of the cost of carbons and attendance, the lamp being suitable for external lighting and the illumination of high factory rooms.

DOMESTIC ELECTRIC COOKING.

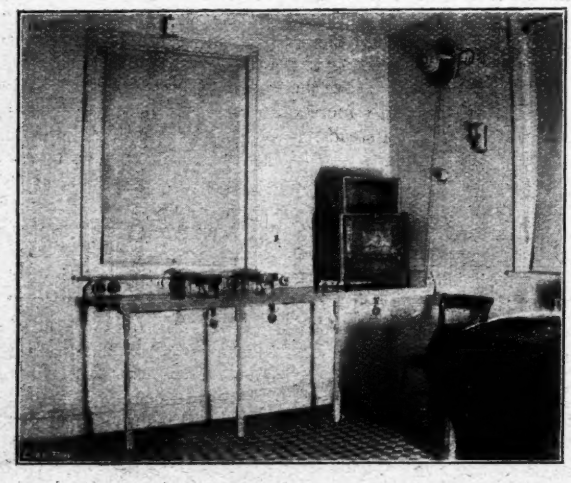
By F. R. CRIPPS.

Although a great variety of apparatus is now on the market, people with experience of electric cooking are still few and far between, and those who recount their experiences are still more rare. For this reason the article by Mr. Farrer in your issue of August 5th is of value to those personally interested.

The weak point about electric cooking utensils is that they invariably seem to be designed by persons whose knowledge of the kitchen is purely theoretical, to say the least of it. Substantial progress in design will not be made until the cooks are brought into touch with the manufacturers.

For over two years the apparatus seen in the view has done all the cooking for the writer's modest household of three persons, and has shown itself to be a commercial success. With a larger family the cost per head would be proportionately lower, as the oven and hot plates have to be large enough to provide for occasional visitors.

The illustration shows a B.T.-H. oven and two Phœnix hot plates, all screwed to a bench made of $\frac{3}{16}$ in. mild steel. This bench is 7 ft. 6 in. long × 21 in. wide, and is enamelled white, as is everything possible in the kitchen. The apparatus is placed where most convenient for use, and



Domestic Electric Cooking

the controlling switches are put where they can be operated under any conditions of boiling over, or other culinary excitement.

The oven, as sent out by the makers, got far too hot outside. This was remedied, at a cost of about 1s. 6d., by making a sheet-iron jacket to fit the top, back and sides at a distance of 1 in., the space being stuffed with slag wool. The exterior never gets too hot to bear the hand upon now, even after the longest run. The three-way and off-position window switch gives demands of 350, 990, 1,460 watts. Though lacking somewhat in head-room, the oven is otherwise as large as that of the ordinary range, and will do anything required of it. Economy is effected by filling the oven when it *is* used; for it is quite easy to bake a dozen rock cakes and a fruit tart with the joint and Yorkshire pudding. The high heat has to be on for about 20 minutes before use, subsequent reduction depending on the nature of the food cooked.

Plate-warming is an important item, and is efficiently carried out by the wooden hood to be seen over the oven. Plates and dishes placed here when the oven is started attain a heat just bearable to the hand by the time they are wanted. If more than this is required, they can be put in the oven for a minute while the dinner is being taken in.

Longer legs had to be fitted to the Phœnix hot plates, which, in common with those of other make, get as hot underneath as on the top. These hot plates are $7\frac{1}{2}$ in. in diameter, and have two heats; the high one absorbing 1,020 watts and the low one, 590. Originally the low heat absorbed about 800 watts, which was too hot for simmering, and so a few coils of iron wire were put in circuit, being strung under the bench on insulators.

The hot plates and oven are connected by wires which are led through the steel bench in fibre tubes, which fit the holes tightly. These tubes project about an inch above the bench, and protect the wires from wet when the saucepans boil over, or when the bench is washed down. The switches are two-way with a middle-off position.

Below each apparatus is seen its pilot lamp, which shows if it is full, half, or not on. This addition prevents waste and bad temper, and uses up old carbon lamps.

On the left of the bench are two wall sockets from which such small apparatus as a kettle, iron, pint and quart B.T.-H. saucepans (very reliable), or radiator can be used. Two sockets are required, as, *e.g.*, they are used each morning for the simultaneous heating of milk and coffee.

The advantage of the bench is that it takes up hardly any room, and the apparatus can be properly fixed and connected; also the kitchen table can be smaller because of it.

The porthole fan keeps the kitchen the coolest room in the house in summer. The cord seen hanging from it is used to close the outside shutter.

Before the all-important question of cost is mentioned, it should be explained that the writer indulges in electric cooking not merely because of its novelty, or the immense saving of labour achieved, or the extra cleanliness and comfort enjoyed by all members of the household, but also because, at 1d. per unit, it saves money. Electricity for house warming being financially out of the question, the maid has to be prevented from freezing for a few months in the winter by keeping the kitchen fire going. During this time the cooking is, of course, done by the range, coal for which averages 4d. per diem. During the past "summer," when, except for a small use of a radiator for airing clothes, practically all power-rate current has been used for cooking; the daily average consumption has been 2·57 units.

After the meal has been cooked and eaten comes the washing-up, and this requires large quantities of hot water. The writer regrets that he could find nothing electrical on the market to compare with Ewart's "Califont" water heater for supplying unlimited hot water for scullery, bath, and two hand-basins; though the simple device of Messrs. M. Cooper, of Glasgow, of running water through flexible metallic tubing, the two ends of which are put across the mains, seems to have possibilities.

In conclusion, the writer would urge the desirability of eliminating the use of flex from electric cooking devices. With even two utensils connected at once it becomes a veritable wire entanglement for the cook. Also the constantly necessary shortening and replacement of flex, though a small expense, is a great nuisance, because each simple breakage of a wire means, perhaps, a complete breakdown of cooking, with the possibility of spoiling the dinner. It cannot reasonably be expected that cooks should have any electrical knowledge. What is required is a combination of the electrical efficiency of the self-heated utensil with the mechanical efficiency of the fixed hot-plate.

Chinese Shop Students.—American Vice-Consul-General Stuart J. Fuller, of Hong Kong, writes home calling attention to the published offer of an English electrical manufacturer to receive, on what apparently corresponds to the American college apprentice system, a few Chinese. Mr. Fuller says:—

"The value of this far-sighted measure to the particular concern, as well as to English manufacturers in general, can not be overestimated. American electrical manufacturers have for years reaped the advantages of this system in the decided preference that their former apprentices, located both in the United States and abroad, show for the type of apparatus in whose manufacture and use they have been trained. I have never heard of such an offer from American sources addressed to Chinese, but see no reason why the plan should not be feasible, provided the small wage paid would not avoid student status with regard to the Chinese exclusion laws."

THE ELECTRIC LIGHTING OF BOWLING GREENS.

By W. G. RHODES, D.Sc., Royal Technical Institute, Salford.

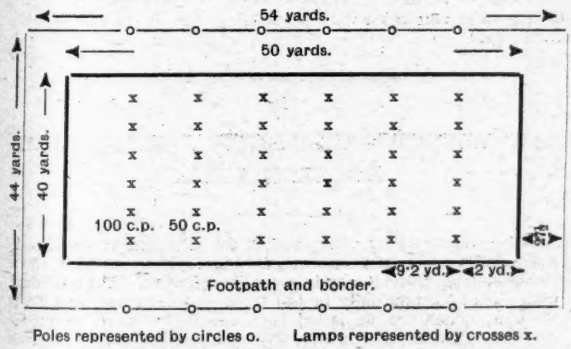
The game of bowls has long been almost a national pastime. Was not Sir Francis Drake playing bowls at Plymouth when the Spanish Armada hove into sight? Was he not playing so keenly that he declared he would finish the game and then go and beat the Spaniards?

Not less keen are the bowlers of to-day, more especially in Scotland and the North of England. The game is patronised chiefly by artisans and the lower middle class—men who are engaged during the day and whose hours of recreation do not commence until six, or seven, or even later in the evening. It being essentially a game requiring light, the number of weeks during the year available for play in the evening is very limited, being practically confined to the months of June and July. As April, May, August and September are often fine and warm, many attempts have been made to illuminate greens by artificial light, but not until recently has this been done satisfactorily.

It is highly desirable that the illumination should be such as not to cast shadows either of the bowls or the bowlers. The problem thus resolves itself into the uniform ground illumination of an open space. The intensity of the illumination is not of so much importance as its uniformity.

The idea of lighting greens by electricity is not new. The early attempts were made by placing high candle-power arc lamps either round the green or slung across at a few places. This, however, proved unsatisfactory, on account of the absence of uniformity of the illumination and the shadows of objects near the arc lamps.

About two years ago the writer was asked by the members of a club near Manchester, with a bowling green attached, to superintend an electrical installation. The green is rectangular in shape, being about 50 yards long by 40 yards in width. Round the green is a border and footpath. The accompanying figure illustrates the method adopted.



PLAN OF BOWLING GREEN.

In all there are 36 Osram lamps, 32 being 200-volt 50-c.p., while the four corner lamps are 200-volt 100-c.p. These are suspended at a height of about 11 ft. above the green.

Method of Suspension.—The figure shows that the spans are across the width of the green, being about 44 yards long. Six poles are placed equidistant along each long side of the green, just outside the footpaths. The poles are of creosoted wood, 16 ft. long, let into the earth to a depth of 3 ft., the base resting on a flag to secure firm foundation; they are further stayed by stranded steel wire to any convenient stable object, such as a tree or a wall. Near the top of each pole is bolted a stout wooden cross-bar, about 18 in. long, on the top of which, one on each side of the pole, are fixed two porcelain telegraph insulators, which carry the bare No. 8 s.w.g. solid copper conductors which span across the green to two similar insulators on the corresponding opposite pole. Fastened to corresponding opposite poles and about a foot below the copper conductors is a 7/14 stranded steel wire, drawn as tight as possible. This carries the watertight porcelain lamp-holders, and thus takes all tension off the copper conductors, except that due to their own weight.

From the switchboard, insulated cables are carried to two porcelain insulators fixed on the back of the nearest pole, whence No. 8 copper conductors are carried the length of the green (one side) by means of similarly fixed insulators on the back of the other five poles. To these conductors the span conductors are connected through a watertight switch placed about 6 ft. up each pole, so that in the event of any span failing it can be cut out without affecting the remaining spans. The terminals of the lamp-holders are connected to the span conductors by means of slack flexible wires. Above each lamp, and attached in the usual way, is a 12-in. enamelled shade of wide angle.

The inclusive cost of such an installation is about £60, depending on the size of the green.

The cost of energy for the installation described is about 9d. per hour (2·4 units at 3½d. per unit).

An extra greenage of 2d. per player for a game of 11 up is charged to cover cost of energy, depreciation, and renewal of lamps.

In the winter the lamps, shades, and holders are taken down to prevent local dripping of rain, which would act deleteriously on the turf.

This is the third season the light has been used, and it has given every satisfaction. The installation was fixed by Messrs. Pearson & Co., 51, Moseley Street, Manchester, under the writer's supervision.

THE "M.P." WIRING SYSTEM.

A new patent wiring system, the invention of Mr. Sarsfield W. Martyn, is being brought out by Messrs. S. W. Martyn & Co., of 11, Pratt Street, N.W. It is intended to cheapen and simplify the work of installation of electric light and power, by reducing the number of parts required, dispensing with conduit and casing, and eliminating soldered joints. In order to attain these objects the

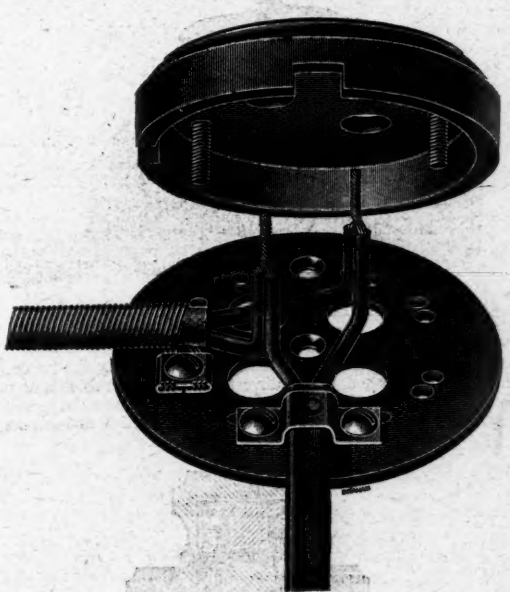


Fig. 1.

inventor proposes to use twin armoured flexible cable, with a simple fitting on which can be mounted a switch, ceiling rose, junction box or wall plug, and an equally simple device for mounting the main fuses, switches and distribution boards. It is claimed that the system can be employed by any mechanic of average intelligence, and that in operation it will prove both safe and reliable.

Two types of cable are used with the "M.P." system—twin flat lead-covered cable, which has already been widely used for many years, and possesses the advantages of neatness and flexibility; and twin round cable armoured with galvanised-iron wires, the latter being wound on the cable in a close spiral, not with the usual long lay. The fitting for mounting switches, ceiling roses, &c., consists simply of an ordinary wooden block mounted on a metal plate, with spring washers or clips for bonding the sheathing, and that for main switches and fuses takes the shape of a flat box with similar bonding arrangements inside. The accompanying illustrations

show the chief features of the system, which, it will be seen, covers a wide range of applications. Either type of cable can be used according to requirements, and the armoured type can be sunk in plaster. The standard size of cable for connecting the distribution boards with the standard fittings is No. 3/22 S.W.G.

Fig. 1 shows the standard plate provided with holes for every purpose, including 16 tapped holes for the screws which hold the

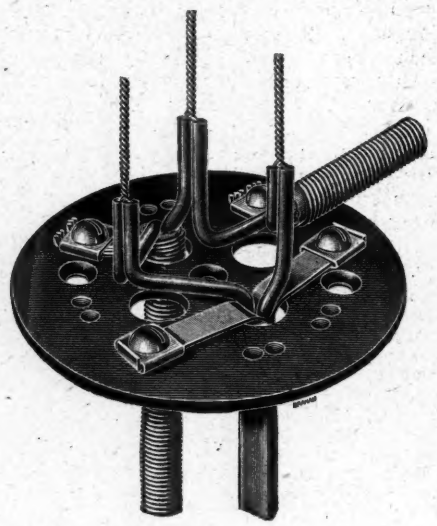


FIG. 2.

bonding clips; both types of cable are shown in position and bonded, with the conductors ready for connection to a fitting, and the wood block notched to suit the cables. The back plate provides 12 distinct paths for cables to enter—eight from the side and four from the back—and can accommodate as many as eight

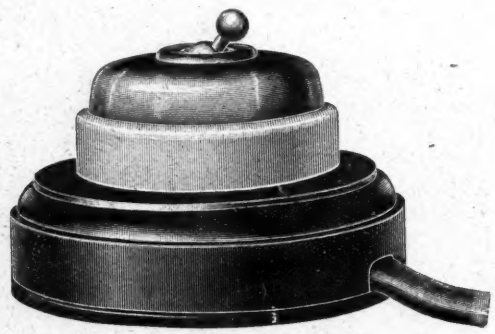


FIG. 3.

circuits. The block is attached to the plate by the two screws shown. The method of bonding the armoured cable is obvious; in the case of the lead-covered type solder is necessary, which is put in through the hole in the top of the clip. A template is pro-

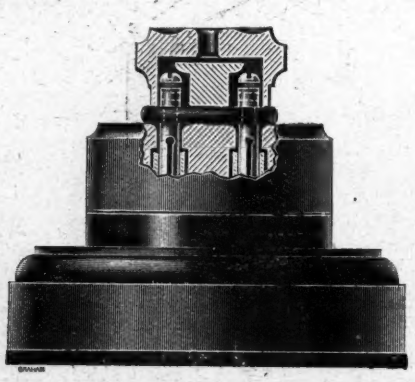


FIG. 4.

vided for accurately and easily marking the positions of the notches in the block where the cables enter. Fig. 2 shows the plate as used for cables entering from the back as well as the side; here the last-named cable may be taken to be the feeder, the lead-covered cable a switch-wire, and the other armoured cable a lamp circuit, the twisted ends being clamped in a three-plate ceiling rose used as a junction box. Fig. 3 shows an English flat-type 5-ampere switch mounted on the block and back plate, and connected to twin flat lead-covered cable. Provision is made in this switch for earthing all exposed metal parts to the back plate.

Fig. 4 represents an improved pattern of wall socket and plug, the terminals of the former being protected, and a new type of cord grip provided in the latter. We may mention that each switch, with its wooden block and back plate, is packed in a neat cardboard box, complete—not assembled, but ready for use, and the same applies to the wall plugs, roses, &c. Screws and bonding clips are not included, as the number of cables to be connected cannot be foreseen.

Fig. 5 shows part of the backboard of a three-way distribution fuseboard with both types of cables in position, and space for a third cable. The bonding is effected by means of the standard clips

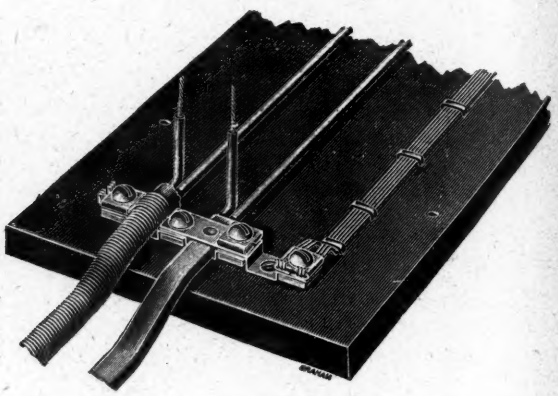


FIG. 5.

and brass plates, held together by bolts and nuts. If other cables enter the box, the bonding is carried round with the waste wire from the armouring of the round cables, stapled to the board as shown. A box-shaped block may be screwed to the backboard, and the fuses mounted on it, or a fuseboard with hinged cover can be used.

Further details are given in a pamphlet issued by the makers, who claim a reduction of 60 per cent. in labour costs, and the small variety of the parts to be stocked is also a notable feature of the system. It will be seen that the inventor has worked on original lines, and we trust that his ingenious system will help to reduce the cost of wiring installations—one of the most important desiderata in connection with the development of electric lighting nowadays.

AN ELECTRICALLY-DRIVEN REVERSING ROLLING MILL.

A 44-in. reversing steel rolling mill at the Rheinischen Stahlwerke was recently converted from steam driving to electric driving, on the Ilgner system, without any interruption of work. The mill deals with some 1,500 tons daily in the form of blocks weighing 2·5 to 3·3 tons, which are subjected to a ninefold elongation on the average. The electrical installation was supplied by the Siemens-Schuckert Co., and consists of an 8,500-H.P. 1,300-volt main double motor regulated by the Ward-Leonard method between 0 and 40 R.P.M. (with a torque of 150 metre-tons), and by field regulation between 40 and 60 R.P.M. with correspondingly reduced torque. The two armature hubs of the double motor are rigidly bolted together, because owing to transport difficulties, a common shaft running right through could not be used.

The whole machine is completely enclosed, and is artificially cooled by a supply of fresh air from a fan. A small iron shed is also erected over the machine, but this can be bodily removed by the crane when desired.

In order to make the motor follow the field variations rapidly, the excitation is arranged so that a comparatively small proportion of the voltage falls on the field winding, the rest being absorbed in non-inductive resistance. By this means it is found possible to work up to 20 reversals per minute.

By means of an emergency switch the excitation of the control dynamo can be switched off when desired, and this switch is also controlled by a maximum cut-out. During the intervals of rolling the driver releases a foot lever, by means of which the excitation of the main motor is removed, and the controller handle is locked. The whole arrangement is shown in fig. 1. The fly-wheel, mounted on the shaft of the three exactly similar control machines, weighs 38 tons, and has a diameter of 4·4 metres, which gives a peripheral speed of 101 to 83 metres per second at 440 to 360 revolutions per minute. The maximum stored energy is thus 200,000 H.P.-seconds. The control motor is built for 1,800 H.P. at 525 volts. The two control dynamos generate between them 1,300 volts, and are flexibly coupled to the fly-wheel. Regulation of the current to a constant uniform value is effected by current relays, which control a

number of automatic switches cutting out resistances in the exciting circuit of the control motor. The whole installation was set to work without interruption of the steam drive. The official trial showed that the power used per ton of metal varies very considerably according to the temperature, and is too indefinite to enable

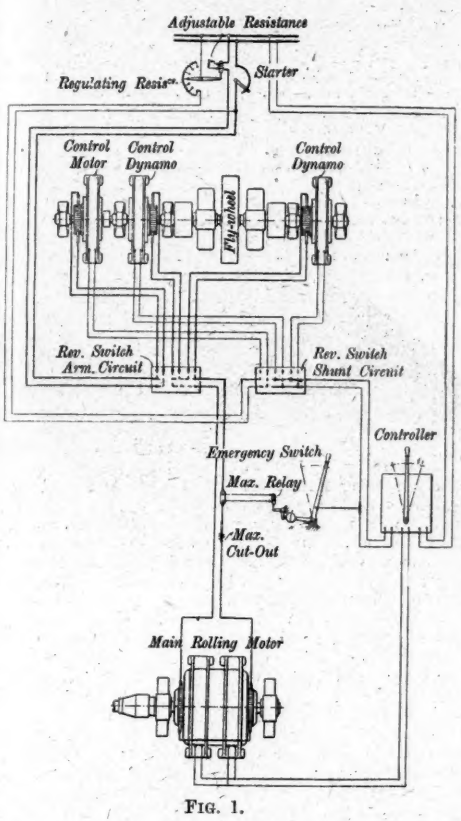


FIG. 1.

exact predetermination of power to be made from the test results hitherto published. Fig. 2 shows a typical power diagram obtained whilst rolling a hard block weighing 3·3 tons and lengthening it 14·1 fold in 21 reversals. Approximately 17 KW.-hours were found

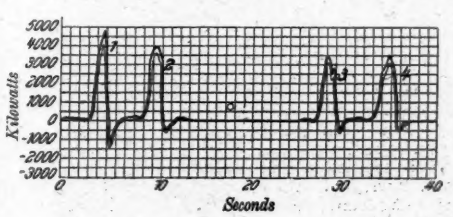


FIG. 2.

necessary in rolling soft material to a nine-fold elongation, and it was found possible to deal with 59·2 to 72·5 tons of hard, or 65·5 to 79·5 tons of soft, material per hour, assuming a nine-fold elongation.

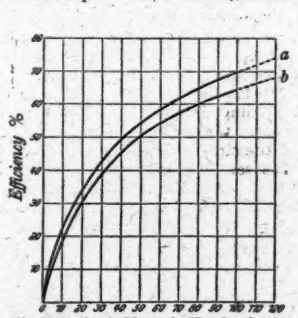


FIG. 3.

From the rolling energy and the electrical energy absorbed by the electric drive, the efficiency curve shown in fig. 3 has been obtained. In this the horizontal scale represents percentages of the normal full-load hourly output. Curve *a* is for soft, and *b* for hard material.—*E.T.Z.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—Invoices and consignment notes should state the gross weights of packages and the net weights of contents, which should be fully described. The country of origin should be stated. When various descriptions of goods are packed together, the net weight of each class should be stated separately. Marks should be simple, and shippers should personally inspect the marks and numbers on packages, and be careful that they agree exactly with the invoices and bills of lading, otherwise heavy fines are incurred. The invoices should be signed by the merchants. Steamship companies require two plain bills of lading with each set. No alterations or corrections must appear on the documents. The following duties are payable :—

Rouble = 2s. 1½d. ; poud = 36 lb. ; funt = ·902 lb.

	Roubles per poud.
Belting for machinery, sewn	·30 per funt.
" " " unsewn	10
Asbestos yarn or manufactures, whether in combination with other materials or not	3·50
Moulded carbon wares for electro-technical purposes, such as arc light carbons, plates, cylinders, &c. :	
Weighing less than 10 funts each	6
" 10 funts or more each...	1
Porcelain wares, white	7
Earthenware, white	1·65
India-rubber and gutta-percha :	
Unmanufactured ; also india-rubber waste, unfit for use as a manufacture...	1·50
Prepared or manufactured :	
In sheets, plates, sticks, pipes, or liquid, and india-rubber threads	·20 per funt.
Articles of soft india-rubber or gutta-percha (except boots or shoes), in combination with other materials ; gum lac	·30 " "
Ditto, of hard india-rubber or gutta-percha (except boots or shoes and clothing), in combination with other materials or not... ...	·50 " "
Iron rails, plain, perforated and grooved	·90
Iron wire having a diameter of—	
Less than ¼ in., but not less than $\frac{1}{16}$ in.	1·80
" $\frac{1}{16}$ in., " " $\frac{1}{30}$ in.	2·30
" $\frac{1}{30}$ in., " " $\frac{1}{85}$ in.	3·30
" $\frac{1}{85}$ in.	4·70
N.B.—Wire coated with common metals in a proportion exceeding 25 per cent. of the total weight is subject to a surtax of 50 per cent. of the amount of duty payable at the above rates.	
Steam boilers	2·10
Iron or steel wire, whether coated with tin or zinc or not, covered with textile materials (other than silk) or with gutta-percha :	
Not containing wire less than 1 mm. thick ...	5·60
Containing wire less than 1 mm. thick... ...	7
Iron or steel wire covered with silk, mixed or not :	
Not containing wire less than 1 mm. thick ...	8·40
Containing wire less than 1 mm. thick... ...	10·50
Wire of copper or copper alloys, with diameter :	
From 12·5 mm. to ·5 mm., inclusive	7·35
" ·5 " ·2 " "	10·35
Less than ·2 mm.	11·85
N.B.—All wire coated with tin, zinc, or other common metal pays a surtax of 50 per cent. of the amount of duty payable at above rates.	
Wire of copper (even in the form of a bunch or cable) covered with fibrous materials, gutta-percha, caoutchouc, or other common materials, the diameter of the separate wires being :	
·2 mm. or more	16·20
Less than 2 mm.	17·70
Wire of copper covered with silk, whether such silk be mixed with other fibrous substances or not :	
·2 mm. or more in diameter	24·30
Less than ·2 mm. "	26·55
Electric cables of all kinds	6·70

(To be continued.)

Lift Fatality at Cape Town.—Our Cape correspondent writes stating that a man named Carl Rutgers was killed at Messrs. Van der Byl's store, Dock Road, on July 27th, by the falling of an electric elevator. At the inquest drawings of the scene of the accident were put in by Mr. John Denham, Government Electrician, who reported that he had found everything satisfactory. The foreman said that, hearing an unusual noise, he went to the lift well, and found that the cage had fallen. The wire rope was off the drum, and was broken. The deceased man was found under the cage at the bottom of the lift well, and it is supposed that he had gone to the well for some purpose, and the cage had fallen on him. The magistrate found that the death was accidental, and that the lift was quite good for the purpose for which it was used.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,119. "Improvements in and connected with secondary batteries or storage cells." V. DE KARAVODINE. August 15th.

19,125. "Improvements relating to electric switches." W. P. SCOTT. August 15th.

19,164. "Improvements in the ventilation of dynamo-electric machines." SIEMENS BROS. DYNAMO WORKS, LTD., and E. O. KIEFFER. August 15th. (Complete.)

19,182. "Improvements in electrical switches." N. COLLINS. August 16th.

19,199. "Improvements in or applicable to electric bells." C. HERRDE. August 16th.

19,236. "Improved galvanic apparatus." R. BLASBERG. August 16th.

19,241. "Improvements relating to ignition in multicylinder internal combustion engines." Firm R. BOSCH. (Date applied for under Sec. 91 of the Act, December 18th, 1909, being date of application in Germany.) August 16th. (Complete.)

19,242. "Improvement relating to ignition in large internal combustion engines." Firm R. BOSCH. (Date applied for under Sec. 91 of the Act, April 6th, 1910, being date of application in Germany.) August 16th. (Complete.)

19,282. "Electric signalling apparatus." C. J. HERBECK and L. HOLZ. August 17th. (Complete.)

19,291. "Improvements in fittings for overhead wires." A. R. WALMSLEY. August 17th.

19,330. "Improvements in igniting appliances for smokers' uses and other purposes." H. ALLDAY (trading as Horton & Allday). August 17th. (Complete.)

19,359. "Improvements relating to alternating current motors." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 17th.

19,365. "Electric valve or cerium manipulator." J. STANMORE and F. STANMORE. August 18th.

19,411. "Improvements in side walks with coloured translucent advertising plates which may be intermittently or continuously lighted by electric lamps." L. BERTRAND. August 18th. (Complete.)

19,449. "Improved method of separation by magnetic influence of zinc, copper, and other sulphide ores." W. M. MARTIN. August 19th.

19,466. "Improvements in electric heating and/or cooking stoves." O. C. HAWKES. August 19th. (Complete.)

19,525. "Improvements in contact breakers for use in connection with the ignition systems of internal combustion engines." B. BROOKS and F. H. ALSTON. August 20th.

19,532. "New or improved electrical lamp for motor-cars, cycles, and any other vehicles." J. W. ESSER and C. HODGKINSON. August 20th.

19,539. "Improvements in commutators for dynamo-electric machines." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) August 20th. (Complete.)

19,557. "Improvements in electro-magnetic alternating-current apparatus for obtaining, measuring, regulating motive or adjusting movements." F. KRIZIK. (Date applied for under Rule 13, May 27th, 1910, an invention comprised in application No. 651, dated January 10th, 1910.) August 20th. (Complete.)

19,563. "Improvements in connection with mercury vapour lamps." W. HERAEUS and H. HERAEUS. August 20th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

ELECTRIC PLUGS. H. J. Fisher. 12,452. May 26th.

MAST OR POST FOR WIRELESS TELEGRAPHY OR OTHER PURPOSES. S. Eisenstein. 17,215. July 23rd.

ELECTRIC INCANDESCENT LAMP FITTINGS AND THE LIKE. Wardle Engineering Co. and W. Wardle. 17,240. July 24th.

ELECTRIC SWITCHES. H. R. Schultz. 17,274. July 24th.

APPLIANCE FOR PREVENTING FRAUD IN CONNECTION WITH ELECTRICITY METERS. G. Berardi. 17,483. July 27th.

ELECTROMAGNETIC SEPARATOR WITH ROTATING MAGNET DRUM. F. Steinert and H. Stein. 17,490. July 27th. (Date applied for under International Convention, July 27th, 1908.)

INDUCTION MOTORS. J. H. Holmes. 17,520. July 28th.

ELECTRICAL MEANS FOR MAGNIFYING SMALL MECHANICAL EFFECTS. E. S. Heurtley. 17,555. July 28th.

REVERSIBLE VARIABLE-SPEED DYNAMOS. H. Leitner. 17,487. July 31st.

SECONDARY BATTERIES. F. R. Lewis. 18,008. August 5th.

ELECTRICAL SWITCHES. J. H. Tucker. 18,471. August 11th.

COUNTING-TRAINS FOR ELECTRICITY OR OTHER METERS. W. Hamilton and Ferranti, Ltd. 18,691. August 13th.

ALTERNATING-CURRENT MOTOR CONTROLLERS. G. A. Kohler. 21,249. September 17th.

METHOD OF UTILISING THE GASES RESULTING FROM REDUCTION OPERATIONS CARRIED OUT IN ELECTRIC FURNACES, AND ELECTRIC FURNACES FOR CARRYING OUT THE SAME. A. Helfenstein. 24,498. October 25th.

APPARATUS FOR SOLDERING THE FILAMENTS OF INCANDESCENCE LAMPS. C. G. Redfern. (Compagnie Générale d'Electricité.) 25,882. November 3rd.

ELECTRIC GAS-LIGHTERS. F. F. Dier and C. W. Whitcher. 25,574. November 5th.

ELECTROLYTE FOR USE IN ELECTRIC BATTERIES. New Ignition Syndicate and R. Sandy. 26,649. November 15th. (Application for Patent of Addition to No. 10,520 of 1908.)

ACCUMULATOR PLATES. R. de Laminiere and Soc. Anon. des Accumulateurs de Laminiere. 27,976. November 30th. (Date applied for under International Convention, December 8th, 1908.)

1910.

TREATMENT OF METALS OF THE CHROMIUM GROUP. British Thomson-Houston Co., Ltd. (General Electric Co.) 3,981. February 17th.

MAGNETO-ELECTRIC MACHINE FOR VELOCIPEDE LAMPS AND LAMP-HOLDER THEREFOR. C. Schlick. 5,043. February 28th.

ELECTROMAGNETICALLY ACTUATED ELECTRIC SWITCHES. Adams Manufacturing Co. (Cutler-Hammer Manufacturing Co.) 5,801. March 9th.

ELECTRIC FREQUENCY CONVERTERS. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 7,292. March 23rd.

METAL-FILAMENT LAMPS HAVING FILAMENT CARRIERS ARRANGED ELASTICALLY. O. Krause. 349. January 6th. (Date applied for under International Convention, July 5th, 1909. Originally included in No. 22,458 of 1909.)

ELECTRIC SWITCHES. A. H. Midgley and C. A. Vandervell. 5,571. March 5th.

ELECTRICAL SIGNALLING APPARATUS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 7,154. March 22nd.

STARTING OF POLYPHASE ELECTRIC ASYNCHRONOUS MOTORS. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 7,822. March 31st.

REVERSIBLE VARIABLE-SPEED DYNAMOS. H. Leitner. 8,219. April 5th. (Date applied for under Rule 13, July 31st, 1909.)

POLYPHASE ELECTRIC COMPENSATED SERIES MOTORS. (Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 9,046. April 14th.

SPARK PLUGS. R. Smith. 9,618. April 20th.

ELECTRIC SWITCHES. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 10,423. April 29th.

Exhibitions.—At the Naval, Mercantile Marine and General Engineering Exhibition which is being held at Olympia from September 1st to September 26th, MESSRS. CLARKE, CHAPMAN AND CO., LTD., are showing a number of photographs of their various productions, including all classes of ships' deck machinery, windlasses, winches, capstans, &c., driven both by steam and electricity; electric machinery of all descriptions, including hauling gears, searchlight projectors, &c., water-tube boilers (Woodeson's patents), direct-acting steam feed pumps, and various models, including one of the Clarke-Chapman water-tube boiler (Woodeson's patents).

Among firms who attach great importance to showing at Exhibitions in these altering times is the COMBINATION METALLIC PACKING CO., LTD., of Gateshead. They have been in evidence at most home and foreign exhibitions of importance during recent years, and have secured the highest International awards, and have also met with success in competition in the foreign markets, while keeping a secure position at home. The firm have arranged for representative exhibits of their manufactures to be shown at the Olympia Exhibition, and also at the Exhibition which is to be held at Manchester from October 14th to November 5th.

THE WORTHINGTON PUMP CO., LTD., are exhibiting at Olympia the following plant:—1,600 sq. ft. Worthington surface condenser, with electrically-driven Worthington centrifugal circulating and hot-well pumps and Worthington rotary air pump. The motor for this set is supplied by the Lancashire Dynamo and Motor Co., Ltd.; a 4-in. three-stage Worthington centrifugal boiler-feed pump, driven by 50-H.P. steam turbine. This feed pump is arranged to supply the feed water to the locomotive multitubular boiler supplied by Messrs. Robey and Co., Ltd.; one 1½-in. two-stage Worthington centrifugal house-tank pump, motor driven; one 1-in. single-stage Worthington centrifugal house-tank pump, motor driven; 4¾-in. × 4¾-in. Worthington vertical electrically-driven air compressor, the motors used in connection with these three exhibits being supplied by Messrs. Veritys, Ltd. The foregoing exhibits will be worked at fixed periods daily during the run of the Exhibition. A 15 × 10 × 18 Worthington vertical Simplex Admiralty pattern feed pump will be on view; also a 3-in. Worthington marine centrifugal pump direct-connected to a steam engine manufactured by Messrs. Alley and McLellan, and a number of other Worthington standard low-lift centrifugal pumps.

Copper.—Discussing the general outlook and the figures of the American Copper Producers' Association for July, the writer of an article in the *Financial Times* of August 19th does not appear to find much reason to anticipate further hardening of the price at present. He points out that stocks were increased during July by 1,000 tons, and at present stand at 76,179 tons as compared with 54,730 tons at the corresponding date last year, and 43,957 tons at the end of January, 1910. Whatever limitation in output has taken place is ascribed to the clog on operations provided by the hot weather. Exports for the seven months only total 161,508 tons, against 179,645 tons for the corresponding period last year; this is explained by the presence of such a large stock in Europe. The writer points out also that a considerable reduction in demand is generally looked for in the second six months. With reference to the "merger" it is pointed out that news is still to seek. The report that it is to consist of the Utah Copper Co., the Nevada Consolidated, Calumet and Hecla, and the Phelps-Dodge interests, together with the Anaconda mine, with possibilities of the Rio Tinto and the support of the Rothschilds, still lacks confirmation. Obviously, a combination of this kind must be effected quietly, in order to alarm the market as little as possible until the greatest possible number of interests have been absorbed. Various indications, according to the article, exist of continued increase in production from Australia and Central Africa, and increase in prices would, of course, at once be followed by activity on the part of many concerns at present lacking the stimulus.